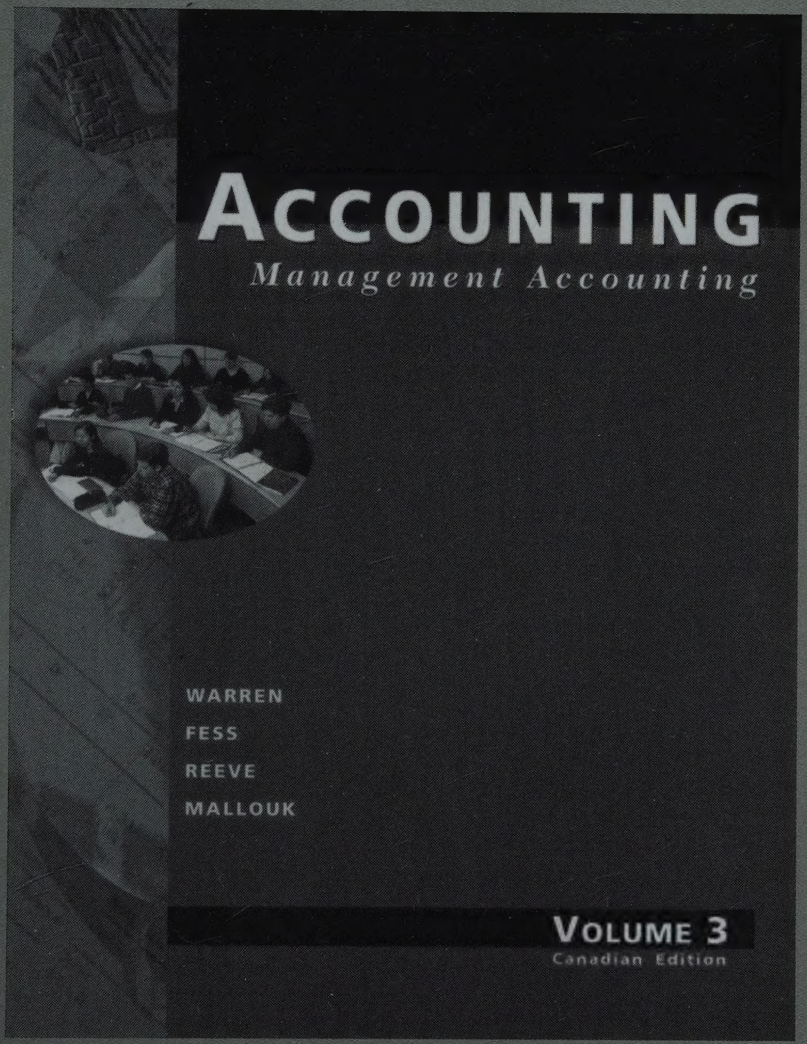
STUDY GUIDE TO ACCOMPANY

ACCOUNTING
MANAGEMENT ACCOUNTING

Warren • Fess • Reeve • Mallouk



VOLUME 3
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Prepared by
Heintz, Warren, and Dyck

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Prepared by

James A. Heintz
University of Connecticut, Storrs

Carl S. Warren
University of Georgia, Athens

Kim Dyck
Red River Community College, Winnipeg

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17 Managerial Accounting Concepts and Principles

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 17.

1. This chapter introduces managerial accounting concepts and terminology. Instructors normally test this material using true/false and multiple-choice questions. You should carefully review all the terms introduced throughout the chapter. The Key Terms are a useful study aid.
2. You should be able to describe the five phases of the management process. You will be able to describe how the five phases interact with each other. It also is important to be able to distinguish between direct and indirect costs; direct material, direct labour, and overhead; and product and period costs.
3. You also should be aware of current trends in business and their implications for management accounting. These trends include just-in-time manufacturing, total quality management, computer-integrated manufacturing, and globalization.

CHAPTER OUTLINE

I. The Differences Between Managerial and Financial Accounting.

A. Although economic information can be classified in many ways, accountants often divide accounting information into two types: financial and managerial.

1. Financial accounting information is reported in statements that are useful for persons or institutions who are "outside" or external to the organization, such as shareholders, creditors, government agencies, and the general public. These statements are prepared according to generally accepted accounting principles (GAAP).

2. Managerial accounting information includes both historical and estimated information used by management in conducting daily operations, planning future operations, and developing overall business strategies.

3. Managerial accounting reports may stress different features of the business and provide different information, depending on the needs of management.
   a. Useful managerial accounting reports provide both objective measures of past operations and subjective estimates about future decisions.
   b. The accountant is not restricted to reporting according to generally accepted accounting principles.
   c. Managerial accounting reports may be provided at any time management needs information.
   d. Managerial accounting reports can be prepared to report information for any unit of the business to support decision making.

II. The Role of the Management Accountant.

A. The operating structure of an organization can be diagrammed in an organization chart.

B. The individual reporting units in an organization can be viewed as having either (1) line or (2) staff responsibilities.
   1. A line department or unit is one directly involved in the basic objectives of the organization.
   2. A staff department or unit is one that provides services, assistance, and advice to other departments. A staff department has no direct authority over a line department.

C. The chief accountant in an organization occupies a staff position and is called the controller.
   1. Because of the critical role of the controller in providing information for management's use, the controller is considered a member of the senior management.
   2. The controller's staff often consists of several accountants, each of whom is responsible for a specialized accounting function. Such functions include systems and procedures, general accounting, budgets and budget analyses, special reports and analyses, taxes, and cost accounting.

D. Ethics are moral principles that guide the conduct of individuals, when they are acting alone, as members of a profession, or as employees of an organization.
   1. The Society of Management Accountants of Canada has developed guides called Standards of Ethical Conduct for Management Accountants. These standards comprise four major categories: (1) competence, (2) confidentiality, (3) integrity, and (4) objectivity.
   2. Three sound principles that form a foundation for ethical behaviour are:
      a. Avoid small ethical lapses.
      b. Focus on long-term reputation rather than short-term pressures to act unethically.

c. Be prepared to suffer adverse consequences for holding to your ethical position.

III. Managerial Accounting in the Management Process.

A. The management process has five basic phases: (1) planning, (2) directing, (3) controlling, (4) improving, and (5) decision making.

B. Planning is used by management to develop the organization's objectives and to translate these objectives into courses of action. Planning can be classified as either strategic planning or operational planning.

1. Strategic planning is developing long-range courses of action to achieve goals. Long-range courses of action are called strategies, and can involve periods ranging from five to ten years.
2. Operational planning, sometimes called tactical planning, is the short-term planning used to achieve operational goals. Thus, operational plans complement the strategic plan.

C. Directing is the process by which managers, given their assigned level of responsibilities, run day-to-day operations.

D. Controlling consists of monitoring the operating results and comparing the actual results with the expected results. This feedback allows management to isolate significant departures from plans for investigation and possible remedial action. This philosophy of controlling is sometimes called management by exception.

E. Improving (continuous process improvement) is the philosophy of continuously improving employees, business processes, and products.

F. Decision making is the process by which managers determine to follow one course of action as opposed to an alternative. Decision making is inherent in each of the four management processes described in the preceding paragraphs.

IV. A Tour of Manufacturing Operations: Costs and Terminology.

A. The operations of business can be classified as service, merchandising, or manufacturing.

1. A service business renders services to its customers.
2. A merchandising business purchases goods in a form ready for sale and then retails the merchandise to consumers.
3. A manufacturing business converts materials into a finished product through the use of machinery and labour.

B. The most fundamental term associated with manufacturing operations is "cost." A cost is a payment of cash or its equivalent or the commitment to pay cash in the future for the purpose of generating revenues.

C. Costs are often classified in terms of how they relate to some object or segment of operations, often called a cost object. For example, a cost object may be a product or a sales territory.

1. Costs that can be identified directly with the cost object are referred to as direct costs.
2. Costs that cannot be identified directly with a cost object are indirect costs for that cost object.
3. A cost can be either direct or indirect, depending upon the cost object identified by management.

D. The cost of a manufactured product normally consists of direct materials cost, direct labour cost, and factory overhead cost.

1. The cost of materials that are an integral part of the manufactured product is classified as direct materials cost.
2. The cost of wages of employees who are directly involved in converting materials into the manufactured product is classified as direct labour cost.
3. Costs other than direct materials cost and direct labour cost incurred in the manufacturing process are classified as factory overhead cost, sometimes called manufacturing overhead or factory burden.
4. As a practical matter, if the costs of direct materials or direct labour are not a significant amount of the total product cost, these costs may be classified as factory overhead.

E. Prime costs consist of direct materials and direct labour costs.

F. Conversion costs consist of direct labour and factory overhead costs.

G. For financial reporting purposes, costs are often classified as either product costs or period costs.

1. Product costs consist of the three elements of manufacturing cost: direct materials, direct labour, and factory overhead.
   a. As product costs are incurred in the manufacturing process, they are accounted for as assets and reported on the balance sheet as inventory.
   b. When the inventory is sold, the product costs are reported as cost of goods sold on the income statement.
2. Period costs are recognized as expenses in the period in which they arise. Period costs are generally classified into two categories: selling and administrative.
   a. Selling expenses are incurred in marketing the product and delivering the sold product to customers.
   b. Administrative expenses are incurred in the administration of the business and are not related to the manufacturing or selling functions.

V. Financial Statements for Manufacturing Businesses.

A. The financial statements for a manufacturing business are more complex than those for service and merchandising businesses, since manufacturing costs must be properly recorded and reported. The effect of manufacturing costs on financial statements is primarily reflected in the preparation of the balance sheet and income statement.

B. A manufacturing business reports three types of inventory on its balance sheet: materials inventory, work in process inventory, and finished goods inventory.

1. The materials inventory consists of the cost of direct and indirect materials which have not yet entered the manufacturing process.
2. The work in process inventory consists of the direct materials costs, the direct labour costs, and the factory overhead costs which have entered the manufacturing process, but which are associated with products that have not been completed.
3. The finished goods inventory consists of the finished products that have not been sold.

C. The major similarities and differences in the income statements for merchandising and manufacturing businesses are in the reporting of the cost of the products sold.

1. For both merchandising and manufacturing businesses, the cost of the product sold is called the cost of goods sold.
2. The costs of manufacturing the product, however, which are comparable to the purchases reported by a merchandising business, are called the cost of goods manufactured.

VI. Trends in Business.

A. Managerial accounting continues to evolve with changes in the business environment and management philosophies. This evolution has been especially rapid for manufacturing businesses.

B. The international economy is becoming more and more service-oriented. This service orientation has resulted in a renewed emphasis on applying managerial accounting concepts and techniques to service businesses. Over 72% of the economy in North America is in the service sector.

C. To achieve greater productivity and efficiency, many manufacturers have implemented just-in-time (JIT) manufacturing systems, sometimes referred to as flexible flow manufacturing systems.

1. In JIT systems the emphasis is on manufacturing products or product components only as they are needed (demanded) by the next stage of production or by the marketplace.
2. Because the demand initiates the manufacturing process, just-in-time systems are often called "demand-pull" systems.

3. In JIT systems inventories are reduced to low or insignificant levels.
4. JIT systems also focus on reducing the time required to manufacture a product from start to finish, referred to as lead time or cycle time.
5. JIT systems also place a greater emphasis on quality control and the quality of goods received from suppliers.
6. In JIT systems, managerial accountants devote significant time and effort to measuring the costs and benefits of quality control systems, cycle time, and the reliability and performance of suppliers.

D. Another relatively recent management concept called total quality management (TQM) is defined by two major principles.

1. The organization's primary objective is to earn the allegiance of customers through superior products and services.
2. The organization should achieve customer loyalty by continually improving employees, business processes, and products.

E. Computer-integrated manufacturing (CIM) involves the use of automated equipment to perform routine, repetitive tasks with minimum human involvement.

1. CIM manufacturing adds flexibility to the manufacturing process and allows manufacturers to respond quickly to changing market conditions.
2. CIM manufacturing normally increases factory overhead costs and decreases the amount of direct labour used in the manufacturing process.
3. In CIM manufacturing there is an increased emphasis in managerial accounting on controlling and properly accounting for overhead.

F. All companies face increasing competition from foreign suppliers. In addition, many companies are competing in international markets. Managerial accounting plays an essential role in these complex relationships.

G. Many service industries struggle for profit. As a result, service businesses are increasingly looking to managerial accounting for analyses that will enable them to compete more effectively.

ILLUSTRATIVE PROBLEM

The following is a list of costs that were incurred in the production and sale of snow blowers:

a. Salary of vice-president of marketing.
b. Hourly wages of operators of machinery used in production.
c. Electricity used to run the production machinery.
d. Telephone charges for controller's office.
e. License fees for use of patent for snow blower chute.
f. Gasoline and oil mixture used in mower engines prior to shipment.
g. Salary of quality control supervisor, who inspects each snow blower before it is shipped.
h. Plastic used for outside housing of snow blowers.
i. Cost of advertising snow blowers in a national magazine.
j. Tread for snow blowers.
k. Salary of factory supervisor.
l. Hourly wages of assembly line employees.

Instructions

With respect to the manufacture and sale of snow blowers, classify each cost as either a product cost or a period cost. Indicate whether each product cost is a direct materials cost, a direct labour cost, or a factory overhead cost. Indicate whether each period cost is a selling expense or an administrative expense.

Solution

	Product Cost			Period Cost	
Cost	Direct Materials Cost	Direct Labour Cost	Factory or Manufacturing Overhead Cost	Selling Expense	Administrative Expense
a.				X	
b.		X			
c.			X		
d.					X
e.			X		
f.	X				
g.			X		
h.	X				
i.				X	
j.	X				
k.			X		
l.			X		

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A. Continuous process improvement
B. Controller
C. Conversion costs
D. Cost of goods sold
E. Cost of quality report
F. Costs
G. Direct costs
H. Direct labour costs
I. Direct materials costs
J. Feedback
K. Financial accounting
L. Just-in-time manufacturing systems
M. Management by exception
N. Management process
O. Managerial accounting
P. Operational planning
Q. Prime costs
R. Product costs
S. Strategic planning
T. Strategy
U. Total quality management

_____ 1. Manufacturing systems in which a primary emphasis is on the manufacture of products only as they are needed by the next stage of production or by the marketplace.
_____ 2. Disbursements of cash (or a commitment to pay cash in the future) for the purpose of generating revenues are (?).
_____ 3. Wages of factory workers who are directly involved in converting direct materials into finished products are classified as (?).
_____ 4. The combination of direct labour and factory overhead costs.
_____ 5. Composed of the three elements of manufacturing costs: direct materials, direct labour, and factory overhead.
_____ 6. The combination of direct materials and direct labour costs.
_____ 7. The chief management accountant of a business.
_____ 8. The branch of accounting that uses both historical and estimated data in providing information that management uses in conducting daily operations, in planning future operations, and in developing overall business strategies.
_____ 9. The five basic management functions of (1) planning, (2) directing, (3) controlling, (4) improving, and (5) decision making.
_____ 10. A management approach that involves an ongoing commitment to improving product quality, starting with design and continuing through production.
_____ 11. The development of short-term plans to achieve goals identified in a business's strategic plan.
_____ 12. A management approach that requires all employees to constantly improve processes of which they are a part, or for which they have managerial responsibility.
_____ 13. The philosophy of managing which involves monitoring the operating results of implemented plans and comparing the expected results with the actual results.
_____ 14. The development of a long-range course of action to achieve business goals.

_____ 15. Measures provided to operational employees or managers on the performance of subunits of the organization.

_____ 16. The means by which business goals and objectives will be achieved.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

		True	False
1.	Financial accounting is the area of accounting that provides information to management for use in planning operations and developing strategies.	_____	_____
2.	For a manufacturing business, the total cost of making the product is comparable to purchases reported by a merchandising business.	_____	_____
3.	The primary criterion for report preparation in management accounting is generally accepted accounting principles.	_____	_____
4.	Factory overhead cost is sometimes referred to as manufacturing overhead or factory burden.	_____	_____
5.	Strategic planning is the development of a short-range course of action to achieve business goals.	_____	_____
6.	Product costs are those costs that are used up in generating revenue during the current period and that are not involved in the manufacturing process.	_____	_____
7.	The financial statements for manufacturing businesses are less complex than those for service and merchandising businesses.	_____	_____
8.	For an automobile manufacturer, paint costs would be a direct cost of manufacturing the product.	_____	_____
9.	The controller would be considered a line position.		
10.	Service businesses are likely to find that most managerial accounting techniques do not apply to them.	_____	_____
11.	An accountant must be a CMA in order to practice managerial accounting.	_____	_____
12.	Strategic planning is the development of a short-range course of action to achieve business goals.	_____	_____
13.	Controllers can expect to face ethical dilemmas.	_____	_____
14.	Planning can be categorized as either strategic planning or operational planning.	_____	_____
15.	One of the principles of the controlling phase of the management process is management by exception. .	_____	_____
16.	A cost of quality report can support the improving stage of the management process.	_____	_____

	True	False
17. The use of automated equipment increases factory overhead costs and normally reduces the amount of direct labour used in the manufacturing process.	_____	_____
18. Just-in-time manufacturing systems usually require increased inventories.	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. A manufacturing business reports the following types of inventory on its balance sheet:
- **a.** direct materials inventory
- **b.** work-in-process inventory
- **c.** finished goods inventory
- **d.** all of the above

2. Which of the following is not an example of factory overhead costs?
- **a.** property taxes on factory building
- **b.** insurance on factory building
- **c.** sales salaries
- **d.** amortization on factory plant and equipment

3. Prime costs are a combination of which of the following?
- **a.** direct materials cost and factory overhead cost
- **b.** direct labour cost and factory overhead cost
- **c.** selling cost and administrative cost
- **d.** direct materials cost and direct labour cost

4. Which of the following cost classifications would not include direct labour costs?
- **a.** period costs
- **b.** inventory costs
- **c.** manufacturing costs
- **d.** direct costs

5. A characteristic of managerial accounting is:
- **a.** strict adherence to GAAP
- **b.** a focus on external decision maker needs
- **c.** a focus on management decision needs
- **d.** all of the above

6. Which of the following is not part of the management process?
   a. planning
   b. reworking
   c. improving
   d. controlling

7. Just-in-time manufacturing systems emphasize:
   a. maintaining high inventory levels
   b. manufacturing products or components only as they are needed
   c. avoiding idle time for employees
   d. increasing cycle time

8. The type of planning which involves the development of short-term plans to achieve goals identified in a business's strategic plan is known as:
   a. operational planning
   b. cycle time
   c. strategic planning
   d. total quality control

EXERCISE 17–1

The following is a list of costs incurred by several businesses.

(1) Straight-line amortization on office laser printer.
(2) Straight-line amortization on factory building.
(3) CD-Rom used by a microcomputer manufacturer.
(4) Sales commissions based on microcomputers sold.
(5) Oil lubricants for factory equipment.
(6) Hourly wages of machine operator on shop floor.
(7) Travel and entertainment costs of salespersons.
(8) Magazine subscriptions for executive lounge.
(9) Property taxes on factory building.
(10) Wages of welder on the production line.
(11) Health insurance premiums paid for factory workers.
(12) Fees paid to accounting firm for annual audit and tax services.
(13) Ink used by a specialty printer in newspaper publishing plant.
(14) Gloves used by handlers of hazardous waste generated from the production process.
(15) Transportation costs of raw materials shipped FOB shipping point.
(16) Overtime paid to factory workers.
(17) Salary of vice-president of marketing.
(18) Salary of controller.
(19) Salary of production supervisor.
(20) Fees paid to a consulting firm to analyze the organizational structure of the business.
(21) Cost of advertising in local newspapers.
(22) Wages of an operator of a lathe on the assembly line.
(23) Wiring for use on jobs by an electrical contractor.
(24) Fax machine for use in controller's office.
(25) Electricity costs of running production equipment.
(26) Blank diskettes for use by a software vendor in reproducing software for sale.

Instructions

Classify each of the preceding costs as product costs or period costs. For those costs classified as product costs, indicate whether the product cost is a direct materials cost, a direct labour cost, or a factory overhead cost. For those costs classified as period costs, indicate whether the period cost is a selling expense or an administrative expense. Use the tabular headings found on the next page for preparing your answer. Place an X in the appropriate columns.

	Product Cost			Period Cost	
Cost	Direct Materials Cost	Direct Labour Cost	Factory Overhead Cost	Selling Expense	Administrative Expense
(1)					
(2)					
(3)					
(4)					
(5)					
(6)					
(7)					
(8)					
(9)					
(10)					
(11)					
(12)					
(13)					
(14)					
(15)					
(16)					
(17)					
(18)					
(19)					
(20)					
(21)					
(22)					
(23)					
(24)					
(25)					
(26)					

EXERCISE 17–2

The following is a list of costs that were incurred in the production of personal computers. Place an X in the appropriate column to classify each cost as direct or indirect, using the personal computer as the cost object.

	Direct Cost	Indirect Cost
(1) Maintenance costs on capital equipment based on hours of usage		
(2) Commissions paid to sales representatives based on the number of computers sold		
(3) Straight-line amortization on the capital machinery used to manufacture the computers		
(4) Raw materials used in keyboard production		
(5) Packing foam for shipment of computers		
(6) Hourly wages of operators of plant machinery used in production		
(7) Electricity costs of running production equipment		
(8) Microchips used in the computers		
(9) Surge suppressors included with every computer order		
(10) Payroll taxes on the hourly assembly line employees		
(11) Property taxes on the factory building and equipment		
(12) Cost of advertising this line of personal computers in computer magazines		
(13) Fees paid to auditors for yearly audit		
(14) Printed circuit boards used in production		
(15) Telephone charges for accounting office		
(16) Salary of vice-president of purchasing		
(17) $20,000 monthly cost of storing computers in warehouse		
(18) Cartons for shipping computers		
(19) Telephone charges for toll free customer service number		
(20) Computer screens used in production		

PROBLEM 17–1

The following information is available for Lyons Inc., for the year ended March 31, 20—

Direct labour	$270,000
Direct materials inventory April 1	114,000
Direct materials purchases	700,000
Factory overhead	198,000
Finished goods inventory, April 1	205,000
Work in process inventory, April 1	84,500
Administrative expenses	97,000
Selling expenses	120,000
Sales	1,750,000
Inventories as of March 31, 20—:	
Finished goods	106,000
Work in process	46,000
Direct materials	76,000

Instructions: Using the above information, determine the following in the spaces provided.

(a) Cost of materials used in production

(b) Total manufacturing costs

(c) Cost of goods manufactured

(d) Cost of goods sold

(a) Cost of materials used in production:

(a) Cost of materials used in production:

Direct materials inventory, April 1

+ Direct materials purchases

- Direct materials inventory, March 31

Cost of materials used

(b) Total manufacturing costs

Cost of materials used [see (a)]

+ Direct labour costs

+ Overhead costs

Total manufacturing costs

(c) Cost of goods manufactured:

Work in process, April 1

+ Total manufacturing costs [see (b)]

- Work in process, March 31

Cost of goods manufactured

(b) Cost of goods sold:

Finished goods inventory, April 1

+ Cost of goods manufactured [see (c)]

- Finished goods inventory, March 31

Cost of goods sold

PROBLEM 17–2

Instructions: Based on the information provided in and the solution to Problem 17-1, prepare an income statement for Lyons Inc. for the year ended March 31, 20—.

18 Job Order Costing

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 18.

1. You will likely see some multiple-choice questions covering chapter terminology and the distinction between job order cost and process cost systems. Review the Key Terms for terminology.
2. You should be able to prepare journal entries for the recording of transactions using a job order cost system. Carefully review the chapter illustration of the job order cost system. Also, the Illustrative Problem in the Chapter Review is a useful study aid.
3. Be able to calculate factory overhead application rates using different activity bases.
4. If your instructor discussed activity-based costing and job order cost systems for service businesses, then you should review the related sections of the chapter for possible true/false or multiple-choice questions.

CHAPTER OUTLINE

I. **Usefulness of Product Costs.**

   A. Product costs are used by management for a wide variety of purposes. For example, the per unit cost of finished goods inventory is useful for setting product prices.

   B. Product costs are also used in preparing the financial statements of the business. Product costs are necessary for valuing work in process and finished goods inventories on the balance sheet and in determining cost of goods sold on the income statement.

II. **Cost Accounting System Overview.**

   A. There are two main types of cost accounting systems for manufacturing operations—job order cost and process cost.

   B. A job order cost system provides a separate record of the cost of each particular quantity of product that passes through the factory.

      1. A job order cost system is best suited to industries that manufacture goods to fill special orders from customers and to industries that produce different lines of products for stock.

2. In addition, many service firms use job order cost systems to accumulate the costs associated with providing client service.

C. Under a process cost system, the costs are accumulated for each of the departments or processes within the factory. A process system is best suited for manufacturers of like units of product that are not distinguishable from each other during a continuous production process.

III. Job Order Cost Systems for Manufacturing Businesses.

A. In a cost accounting system, perpetual inventory controlling accounts and subsidiary ledgers are maintained for materials, work in process, and finished goods inventories.

1. All manufacturing costs move through the work in process account, the finished goods account, and eventually into the cost of goods sold account.

2. The flow of costs through the perpetual inventory accounts and into the cost of goods sold account is illustrated in Exhibit 2 of the chapter.

B. Materials cost flows are illustrated in Exhibit 3 in the chapter.

1. Prior to producing a given item, a bill of materials is prepared listing all materials necessary to manufacture the product.
2. The department responsible for scheduling production then informs the purchasing department, by means of a purchase requisition, of the materials that will need to be purchased.
3. The purchasing department issues purchase orders in ordering materials from suppliers.
4. When the materials are received and inspected, a receiving report is completed showing the quantity received and their condition.
5. After the receiving report is reconciled to the vendor's invoice, the entries are made to debit Raw Materials and to credit Accounts Payable.
6. The account Raw Materials in the general ledger is a controlling account. A separate account for each type of material is maintained in a subsidiary ledger called the materials ledger.
7. Manufacturing departments complete materials requisitions to request the transfer of materials from the storeroom to the factory for production.
8. A summary of the materials requisitions serves as a basis for the entry debiting Work in Process (for direct materials) and Factory Overhead (for indirect materials) and crediting Raw Materials.

C. The perpetual inventory system for materials has three important advantages. First, it provides for prompt and accurate charging of materials to production. Second, it permits the counting of inventory to be spread out rather than concentrated at the end of a fiscal period. Third, it aids in disclosing inventory shortages or other irregularities.

D. The two main objectives in accounting for factory labour are the determination of the correct amount to be paid each employee and the appropriate allocation of labour costs to factory overhead and individual job orders.

1. The amount of time spent by an employee in the factory is recorded on clock cards (sometimes called in-and-out cards).
2. The amount of time spent by each employee and the labour cost incurred for each individual job, or for factory overhead, are recorded on time tickets.
3. A summary of the time tickets serves as the basis for recording the entry debiting Work in Process (for direct labour), debiting Factory Overhead (for indirect labour), and crediting Wages Payable.

E. Factory overhead includes all manufacturing costs except direct materials and direct labour.

1. Examples of factory overhead costs include indirect materials, indirect labour, amortization, insurance, etc.
2. Debits to Factory Overhead come from various sources. For example, the cost of indirect materials is obtained from the summary of the materials requisitions. The cost of indirect labour is obtained from a summary of time tickets. The cost of electricity is obtained from invoices.
3. In order to allocate factory overhead to individual jobs on a timely basis, a cost allocation process is needed.
4. To allocate factory overhead costs to production, a predetermined factory overhead rate is utilized. The predetermined factory overhead rate is estimated by dividing the estimated amount of factory overhead for the coming period by some common activity base or activity driver. Common activity bases include direct labour costs, direct labour hours, and machine hours.
5. Actual factory overhead costs incurred are debited to the factory overhead account.
6. Factory overhead costs are allocated to individual jobs by an entry debiting Work in Process and crediting Factory Overhead.
7. Normally, factory overhead costs applied and actual factory overhead costs incurred during a period will differ.
8. If the amount applied to factory overhead exceeds the actual costs, the factory overhead account will have a credit balance and the overhead is said to be overapplied or overabsorbed.
9. If the amount of factory overhead applied is less than the actual costs, the factory overhead account will have a debit balance and the overhead is said to be underapplied or underabsorbed.
10. The balance in the factory overhead account is carried forward from month to month until the end of the year. The balance is reported on interim balance sheets as a deferred debit or credit.

11. At the end of the year, the balance of the factory overhead account must be eliminated. One approach to doing so is to transfer the total balance to the cost of goods sold account.
12. A firm may use a variety of activity bases to allocate factory overhead to jobs. The most common activity base is direct labour hours.
13. Activity-based costing is a method of accumulating and allocating factory overhead costs to products using many overhead rates. Each rate is based on a separate factory activity.

F. Costs incurred in the various jobs are debited to Work in Process. The sources of the job costs debited to Work in Process may be summarized as follows:

1. The direct materials cost is obtained from the summary of materials requisitions.
2. The direct labour cost is obtained from a summary of the time tickets.
3. The factory overhead cost is obtained from a summary of the time tickets.

G. The work in process account is a controlling account that contains summary information only. The details concerning costs incurred on each job order are accumulated in the job cost sheets. Each job cost sheet has spaces for recording all direct materials, direct labour, and factory overhead.

H. When jobs are completed during the accounting period, they are debited to Finished Goods and credited to Work in Process for their total costs.

I. The finished goods account is a controlling account.

1. The subsidiary ledger for Finished Goods is the finished goods ledger, stock ledger, or inventory ledger.
2. Each account in the subsidiary finished goods ledger provides quantities and cost data for goods manufactured, sold, and on hand.

J. In recording sales, the first-in, first-out method of accounting for the cost of finished goods sold is used.

K. A summary of the cost data on the shipping orders is the basis for an entry debiting Cost of Goods Sold and crediting Finished Goods for the cost of the goods sold and shipped.

L. Sales of finished goods are recorded by debiting Cost of Goods Sold and crediting Finished Goods for the cost and debiting Accounts Receivable (or Cash) and crediting Sales for the selling price.

IV. Summary of Cost Flows For Triton Publishing.

A. A detailed illustration of a job order cost accounting system for Triton Publishing Ltd. appears in Exhibit 9.

B. In reviewing the illustration of Triton Publishing Ltd., special consideration should be given to the relationship between the controlling accounts of Finished Goods, Work in Process, and Materials and the related subsidiary ledgers.

V. Job Order Costing for Decision Making.

A. Job order cost information can be used to evaluate an organization's cost performance. The unit costs for similar jobs can be compared over time to determine if costs are staying within expected ranges.

B. If the costs increase for some unexpected reason, the details in the job cost sheets can provide help in determining the causes.

VI. Job Order Cost Systems for Service Businesses.

A. A job order cost accounting system may be useful to the management of a service business in planning and controlling operations. Since the "product" of such a business is service, management's focus is on direct labour and overhead costs. The cost of any materials or supplies used in rendering services for a client is usually small in amount and is normally included as part of the overhead.

B. The direct labour and overhead costs of rendering services to clients are accumulated in a work in process account, which is supported by a cost ledger. A job cost sheet is used to accumulate the costs for each client's job.

C. When a job is completed and the client is billed, the costs are transferred to a cost of services account. This account is similar to the cost of goods sold account for a merchandising or manufacturing business.

ILLUSTRATIVE PROBLEM

Shelton Signs Inc. specializes in production of neon signs and uses a job order cost system. The following data summarizes the operations related to production for November, the first month of operations:

a. Materials purchased on account, $21,750.

b. Materials requisitioned and factory labour used:

	Materials	Factory Labour
Job No. 1	$2,750	$1,700
Job No. 2	3,800	2,000
Job No. 3	2,990	1,450
Job No. 4	5,950	3,800
Job No. 5	3,250	1,900
Job No. 6	900	600
For general factory use	595	500

c. Factory overhead costs incurred on account, $4,300.

d. Amortization of machinery, $1,450.

e. The factory overhead rate is 60% of direct labour cost.

f. Jobs completed: Nos. 1, 2, 4, and 5.

g. Jobs 1, 2, and 4 were shipped, and customers were billed for $7,900, $10,500, and $18,100, respectively.

Instructions

1. Journalize the entries to record the foregoing summarized operations.
2. Determine the account balances for Work in Process and Finished Goods.
3. Prepare a schedule of unfinished jobs to support the balance in the work in process account.
4. Prepare a schedule of completed jobs on hand to support the balance in the finished goods account.

Solution

1.	a.	Materials	21,750	
		Accounts Payable		21,750
	b.	Work in Process	31,090	
		Factory Overhead	1,095	
		Materials		20,235
		Wages Payable		11,950
	c.	Factory Overhead	4,300	
		Accounts Payable		4,300
	d.	Factory Overhead	1,450	
		Accumulated Amortization—Machinery		1,450
	e.	Work in Process	6,870	
		Factory Overhead (60% of $11,450)		6,870

f.	Finished Goods	30,790	
	Work in Process		30,790

Computation of the cost of jobs finished:

Job No.	Direct Materials	Direct Labour	Factory Overhead	Total
1	$2,750	$1,700	$1,020	$5,470
2	3,800	2,000	1,200	7,000
4	5,950	3,800	2,280	12,030
5	3,250	1,900	1,140	6,290
				$30,790

g.	Accounts Receivable	36,500	
	Sales		36,500
	Cost of Goods Sold	24,500	
	Finished Goods		25,000

Computation of the cost of jobs sold:

Job No. 1	$5,470
Job. No. 2	7,000
Job No. 4	12,030
	$24,500

2. Work in Process: $7,170 ($31,090 + $6,870 – $30,790)
Finished Goods: $6,290 ($30,790 – $24,500)

3. Schedule of Unfinished Jobs

Job No.	Direct Materials	Direct Labour	Factory Overhead	Total
3	$2,990	$1,450	$870	$5,310
6	900	600	360	1,860
Balance of Work in Process, Nov. 30				$7,170

4. Schedule of Completed Jobs

Job No. 5: Direct materials	$3,250
Direct Labour	1,900
Factory overhead	1,140
Balance of Finished Goods, November 30	$6,290

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A. Activity base (driver)
B. Activity-based costing
C. Bill of materials
D. Cost accounting system
E. Cost allocation
F. Finished goods ledger
G. General ledger
H. Job cost sheet
I. Job order cost system
J. Materials ledger
K. Materials requisitions
L. Overapplied factory overhead
M. Predetermined factory overhead rate
N. Process cost system
O. Purchase requisitions
P. Receiving report
Q. Time tickets
R. Underapplied factory overhead
S. Work in process

_____ 1. A type of cost accounting system that accumulates costs for each of the various departments or processes within a manufacturing facility.

_____ 2. A branch of managerial accounting concerned with accumulating manufacturing costs for financial reporting and decision-making purposes.

_____ 3. A cost accounting system that provides a separate record for the cost of each particular quantity of product that passes through the factory.

_____ 4. The form or electronic transmission used by a manufacturing department to authorize the issuance of materials from the storeroom.

_____ 5. The amount of actual factory overhead in excess of the factory overhead applied to production during a period.

_____ 6. A measure of activity that is related to changes in cost, and is used to assign overhead costs to cost objects.

_____ 7. The rate used to apply factory overhead costs to the goods manufactured.

_____ 8. The form or electronic transmission used by the receiving personnel to indicate that materials have been received and inspected.

_____ 9. The form on which the amount of time spent by each employee and the labour cost incurred for each individual job, or for factory overhead, are recorded.

_____ 10. An accounting framework based on determining the cost of activities.

_____ 11. The subsidiary ledger containing the individual accounts for each type of material.

_____ 12. The principal ledger, when used in conjunction with subsidiary ledgers, that contains all the balance sheet and income statement accounts.

_____ 13. An account in the work in process subsidiary ledger in which the costs charged to a particular job order are recorded.

_____ 14. The process of assigning indirect cost to a cost object, such as a job.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

		True	False
1.	A cost accounting system uses perpetual inventory procedures in accounting for manufacturing costs. . . .	_____	_____
2.	A process cost system provides for a separate record of cost of each particular quantity of product that passes through the factory.	_____	_____
3.	A process cost system would best be utilized by a law firm.	_____	_____
4.	A publishing company which produces a variety of different publication titles would normally use a process cost accounting system.	_____	_____
5.	The two principal types of cost systems for manufacturing operations are job order cost accounting and process cost accounting systems. . . .	_____	_____
6.	A cost system in which costs are accumulated for each of the various departments or processes within the factory is called a process cost system.	_____	_____
7.	A factory department in need of materials initiates the acquisition by issuing a purchase requisition to the purchasing department.	_____	_____
8.	Materials are transferred from the storeroom to the factory in response to purchase requisitions.	_____	_____
9.	As a practical matter, unless the total amount of the underapplied or overapplied overhead balance is large, it is transferred to Cost of Goods Sold.	_____	_____
10.	If the factory overhead account has a debit balance, the factory overhead is said to be overapplied.	_____	_____
11.	The subsidiary ledger that contains the individual accounts for each kind of product is the finished goods ledger.	_____	_____
12.	A manufacturer that uses a job order cost system for one product must use that system for all products. . . .	_____	_____
13.	Individual factory labour costs are posted to the perpetual inventory account for labour.	_____	_____
14.	The predetermined factory overhead rate is calculated by relating the estimated amount of factory overhead for the period to an activity base. . . .	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. For which of the following businesses would the process cost system be most appropriate?
   - **a.** building contractor
   - **b.** cookie processor
   - **c.** plumber
   - **d.** textbook publisher

2. The department responsible for scheduling production informs the purchasing department of material requirements through the use of which of the following forms?
   - **a.** receiving report
   - **b.** purchase order
   - **c.** purchase requisition
   - **d.** materials requisition

3. The amount of time spent by each employee on an individual job is recorded on a(n):
   - **a.** clock card
   - **b.** time ticket
   - **c.** in-and-out card
   - **d.** labour requisition

4. For which of the following businesses would the job order cost system be most appropriate?
   - **a.** oil refinery
   - **b.** meat processor
   - **c.** electrical utility
   - **d.** textbook publisher

5. The subsidiary ledger that contains the individual accounts for each kind of commodity or product produced is called the:
   - **a.** work in process ledger
   - **b.** finished goods ledger
   - **c.** factory overhead ledger
   - **d.** materials ledger

6. A method of accumulating and allocating overhead costs by the activities that cause the overhead is:
   - **a.** activity-based costing
   - **b.** job order costing
   - **c.** process costing
   - **d.** overhead costing
7. Direct labour may not be a good activity base for allocating costs in:
   - **a.** job order costing
   - **b.** unionized manufacturing environments
   - **c.** automated environments
   - **d.** professional service environments

EXERCISE 18–1

Instructions: Indicate the flow of costs through the perpetual inventory accounts and into the cost of goods sold account for a cost accounting system by connecting with arrows the letters that should be paired together in the following diagram.

Materials		Work in Process		Finished Goods	
Purchased	Dir. used a	e	Finished k	l	Sold m
	Indir. used b	f			
		g			

Wages Payable		Factory Overhead		Cost of Goods Sold	
Paid	Dir. used c	h	Applied j	n	
	Indir. used d	i			
		Other costs			

EXERCISE 18–2

Instructions: Indicate the flow of costs through a service business using a job order cost accounting system by connecting with arrows the letters that should be paired together in the following diagram.

Wages Payable		Work in Process		Cost of Services	
Paid	Dir. Labour a	d	Completed	j	
	Indir. Labour b	g	jobs i		

Supplies		Overhead	
Purchased	Used c	e	Applied h
		f	
		Other costs	

EXERCISE 18-3

Foley Company operates two factories. It applies factory overhead to jobs on the basis of machine hours in Factory 1 and on the basis of direct labour costs in Factory 2. Estimated factory overhead costs, direct labour costs, and machine hours for the year and actual amounts for January are as follows:

	Factory 1	Factory 2
Estimated factory overhead cost for year	$65,000	$243,600
Estimated direct labour costs for year		$580,000
Estimated machine hours for year	20,000	
Actual factory overhead costs for January	$6,050	$20,100
Actual direct labour costs for January		$48,500
Actual machine hours for January	1,800	

Instructions

a. Determine the factory overhead rate for Factory 1 _____

b. Determine the factory overhead rate for Factory 2 _____

c. Journalize the entries to apply factory overhead to production in each factory for January.

JOURNAL PAGE

	DATE	DESCRIPTION	POST. REF.	DEBIT	CREDIT	
1						1
2						2
3						3
4						4
5						5
6						6
7						7

d. Determine the balance of the factory overhead account in each factory as of January 31, and indicate whether the amounts represent overapplied or underapplied factory overhead.

PROBLEM 18-1

Instructions: Below are listed some transactions of Zintor Inc., which uses a job order cost accounting system. Prepare the entries to record the transactions. (Omit dates and explanations.)

(1) Purchased materials costing $60,000 and incurred prepaid expenses amounting to $5,300, all on account.

(2) Requisitioned $23,200 worth of raw materials to be used directly in production ($15,400 on Job 101 and $7,800 on Job 102) and $1,200 worth of materials to be used indirectly for repairs and maintenance.

(3) Factory labour used as follows: direct labour, $35,900; indirect labour, $2,700.

(4) Other costs incurred on account as follows: factory overhead, $12,200; selling expenses, $21,950; administrative expenses, $15,300. (Credit Accounts Payable.)

(5) Prepaid expenses expired as follows: factory overhead, $5,000; selling expenses, $800; administrative expenses, $600.

(6) The predetermined rate for the application of factory overhead to jobs (work in process) was 70% of direct labour cost. (See Transaction 3.)

(7) The cost of jobs completed was $53,000.

(8) The sales on account for the period amounted to $160,000. The cost of goods sold was $110,000.

JOURNAL PAGE

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30						30
31						31
32						32

PROBLEM 18-2

Instructions: Post the following transactions to the proper T accounts below. Identify the postings with the transactions by using the number preceding each transaction.

(1) Purchased materials for $78,000 cash.

(2) Requisitioned $56,000 worth of direct materials and $2,400 worth of indirect materials from the storeroom.

(3) The factory labour cost for the period amounted to $75,000. (Credit Wages Payable.) The labour cost is determined to be $70,000 direct labour, $5,000 indirect labour.

(4) Paid $12,500 for factory overhead costs.

(5) Applied $24,000 of factory overhead to work in process.

(6) The cost of jobs completed amounted to $164,000.

Cash			
Bal.	135,400		

Finished Goods			
Bal.	50,800		

Work in Process			
Bal.	33,800		

Materials			
Bal.	18,000		

Factory Overhead			
Bal.	3,000		

Wages Payable			

19 Process Costing

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 19.

1. The focus of this chapter is accounting for manufacturing operations using a process cost system. You can expect to see at least one problem requiring you to prepare journal entries for process costing or a cost of production report in either the weighted average costing method or the first-in first-out method. The illustration of process costing in the chapter and the Illustrative Problem in the Chapter Review are good study aids.
2. You have to be able to compute equivalent units of production and cost per equivalent unit for both weighted average and first-in first-out methods. In addition to problems requiring the preparation of cost of production reports, expect to see some multiple-choice questions requiring equivalent unit computations for both costing methods.
3. Terminology is important. Study the Key Terms for possible true/false or multiple-choice questions.

CHAPTER OUTLINE

I. Comparing Job Order Costing and Process Costing.

- **A.** The job order costing system is best suited to industries that fill special orders from customers or manufacture a variety of different products in batches.
- **B.** The process costing system is best suited to industries that process a continuous flow of raw materials into a finished state.
- **C.** The main difference between the two systems is the format in which the product costs are accumulated and reported.
  1. In a job order costing system, product costs are accumulated by individual jobs and are summarized on job cost sheets.
  2. In the process costing system, product costs are accumulated by department.

II. Physical Flows and Cost Flows for a Process Manufacturer.

- **A.** The physical flow of materials is illustrated in Exhibit 2 of the chapter.
  1. Conversion costs (direct labour and factory overhead) are allocated to each process.

2. Once all manufacturing processes are complete, the product in its "finished state" is transferred to the finished goods inventory.

B. The cost flows in a process cost system are illustrated in Exhibit 3 of the chapter.

1. Purchased materials are debited to Materials and credited to Accounts Payable.
2. Direct materials used in the first manufacturing process are debited to the work in process account for that particular process, and credited to Materials. In addition, indirect materials and other overhead incurred are debited to department factory overhead accounts and credited to Materials and other accounts.
3. Direct labour for the first manufacturing process is debited to the process's work in process account, and credited to Wages Payable.
4. Applied factory overhead is debited to the same work in process account, using a predetermined overhead rate.
5. The cost of the completed production for the first manufacturing process is transferred to the next process by debiting the work in process account for this subsequent process, and crediting the work in process account for the first manufacturing process.
6. The transferred costs include the direct materials and conversion costs for completed production in the first manufacturing process.
7. The direct labour and applied factory overhead costs for the second manufacturing process are debited to that process's work in process account.
8. Once the product has flowed through every process, the cost of the finished goods is transferred out by debiting Finished Goods, and crediting the work in process account of the last manufacturing process.

III. The Average Cost Method.

A. In a process cost system, the accountant must determine both the cost of the inventory transferred out of the department and the cost of the remaining inventory in the department. In this method of costing, the costs incurred last period (or month) are added to the costs incurred this period, and an average cost for production is arrived at for all finished units.

B. Materials are usually added at the beginning of the production process.

C. In order to determine the cost of the units completed and ending inventory, the following steps will be used:

1. Determine the units to be assigned costs.
2. Calculate the equivalent units of production.
3. Determine the cost per equivalent unit of production
4. Allocate costs to transferred and partially completed units.

D. Step 1: Determine the units to be assigned costs. There are three categories of units to be assigned cost for an accounting period.

1. units in beginning work in process inventory
2. units started and completed during the period

3. units in ending work in process inventory

The total units to be assigned costs can be summarized as follows:

Inventory in-process, July 1, completed in July	500 tonnes
Started and completed in July	600 tonnes
Transferred out to the Casting Dept. in July	1,100 tonnes
Inventory in-process, July 31	400 tonnes
Total tonnes to be assigned costs	1,500 tonnes

E. Step 2: Calculate equivalent units of production. This is the amount of work that could have been accomplished during the given accounting period.

1. Material equivalents is the amount of full units that could have been made with the amount of resources used in production. As is shown on page 811 of your text, the units in ending work in process currently hold their full compliment of materials. The equivalent units of production for materials is therefore the full 1,500 units.
2. Conversion equivalent units is the amount of full units that could have been made with the amount of resources used in production. As is shown on page 811 of your text, the ending work in process is only 25% complete of the total 400 units. This will cause the equivalent units of production to be 75% times 400 units, or 300 units, not complete. When this 300 is removed from the 1,500 total units, the result is 1,200 equivalent units of production.

F. Step 3: Determine the cost per equivalent unit. When we divide the costs of inputs placed into the department, such as materials and conversion cost, by the equivalent units of production, the result is the cost per unit for each input.

1. As is shown in Exhibit 5, the cost for materials results in an average cost of $49.50 for that factor.
2. As is shown in Exhibit 6, the cost for conversion results in an average cost of $11.08 for that factor.
3. Therefore, the total cost for a unit of production is $49.50 for materials, and $11.08 for conversion. The total cost is $ 60.78.

G. Step 4: Allocate costs to transferred and partially completed units. In this step in the process, we are assigning costs to production units. If in fact the production unit cost is correct, the total of the ending work in process will be the exact amount to total the full costs of production.

IV. Bringing It All Together: The Cost of Production Report.

A. The cost of production report is normally prepared for each processing department at periodic intervals (monthly). It is composed of:

1. A title for the department, the name of the report, and the period of time it covers.
2. The units for which we are accountable for and where they are in the process.

3. The cost for which we are accountable for and where they are in the process.

V. Journal Entries for a Process Costing System—Average Cost Method.
As is shown in the journal entries and ledger account flow on page 816 of the text, once the costs are entered into the work in process account for a department the cost of production, report data is used to enter the amount to be debited to the next department and credited out of the department itself.

VI. The First-In, First-Out Method.

A. In a process cost system, the accountant must determine the cost of inventory transferred out of the department and the cost of the remaining inventory in the department. In this method, the costs of the two different accounting periods (last month's costs and this month's costs) are kept separated.

B. Materials are usually added at the beginning of the production; therefore, the beginning work in process consists of last month's cost of materials.

C. In order to determine the cost of the units completed and ending inventory, the following steps will be used:

1. Determine the units to be assigned costs.
2. Calculate the equivalent units of production.
3. Determine the cost per equivalent unit of production.
4. Allocate the costs to transferred and partially completed units.

D. Step 1: Determine the units to be assigned costs. There will again be recognized that there are three categories of units to be assigned costs for an accounting period.

1. units in beginning work in process inventory.
2. units started and completed during the period.
3. units in ending work in process inventory.

   As is shown on page 817 of the text there are a total of 1,500 tonnes to be accounted for.

E. Step 2: Calculate equivalent units of production. This is the amount of work that was completed this period. You will note that unlike the weighted average method, the first-in, first-out method does not include work completed or beginning work in process last period.

1. Material equivalents refers to the amount of material equivalents placed onto production this period. In an examination of the calculation on page 818, you will note that there is not an allocation for materials on beginning work in process. This is shown in Exhibit 9.
2. Conversion equivalents refers to the amount of conversion equivalents placed into production this period. In an examination of the calculation on page 819, you will note that there is not an allocation for conversion on beginning work in process. This is shown in Exhibit 10.

F. Step 3: Determine the cost per equivalent unit. When we divide the current costs incurred for this period only for materials and conversion by the current production,

we arrive at the current equivalent unit of production cost. This cost is not an average of last period's costs and this period. It is a cost that is totally reflective of the true costs of this period.

1. The calculations on page 821 show that the cost of materials is $50.00 not the $49.50 that was arrived at using the weighted average method. In fact the cost in the weighted average method was an average of $50.00 and an old cost lower than $50.00.
2. The calculations on page 821 show that the cost of conversion is $11.40 not the $11.08 conversion as found using the weighted average method. In fact the cost of the weighted average method is once again being pulled down by a lower cost in the prior period.
3. NOTE: The strength of this method of costing is that changes from period to period can be closely monitored for control purposes.

G. Step 4: Allocate costs to transferred and partially completed units. In this step, we assign the costs to the units transferred out and once again check the transferred out amount with the value of the cost of ending work in process.

VII. Bringing It All Together: The Cost of Production Report.

A. The cost of production report is normally prepared for each processing department monthly. It is composed of:

1. A title for the department, the name of the report, and the period of time it covers.
2. The units for which we are accountable and where they are in the process.
3. The cost for which we are accountable and where they are in the process

VIII. Journal Entries for a Process Costing System—First-In, First-Out.

As is shown in the journal entries and ledger account flow on pages 823 and 824 of the text, once the costs are entered into the work in process account for a department, the cost of production report data is used to enter the amount to be debited to the next department and credited out of the department itself.

IX. Using the Cost of Production Report for Decision Making.

A. The cost of production report is a source of information that may be used by managers to control and improve operations. A cost of production report normally lists costs in greater detail to help management isolate problems.

B. In addition to reporting direct materials and conversion costs, the cost of production report also gives information regarding total unit costs. The report can also be restated in per-unit items in order to isolate changes in cost.

C. In addition to unit production cost trends, managers of process manufacturers are also concerned with yield trends.

X. Just-in-Time Processing.

A. Just-in-time processing is a business philosophy that focuses on reducing time and cost and eliminating poor quality within manufacturing and non-manufacturing.

B. In a traditional production process, a product moves from process to process as each function or step is completed. In a just-in-time system, processing functions are combined into work centres, sometimes called manufacturing cells. In these work centres the workers are often cross-trained to perform more than one function. Research has indicated that workers who perform several manufacturing functions identify better with the end product, which helps create pride in the product and improves quality and productivity.

C. The just-in-time reorganization of the manufacturing department may include assigning service activities to each work centre.

D. In a just-in-time system, after workers in a work centre have completed their activities with a product, the product and any additional material are moved to the next work centre. Each work centre is linked with supplier work centres through information that communicates a work centre's need for material. The information is sometimes printed on cards which are called *Kanban.*

E. The primary benefit of just-in-time systems is increased efficiency of operations, which is achieved by eliminating waste and reducing or eliminating non-value-added activities. Just-in-time systems also emphasize continuous improvement in the manufacturing process and the improvement of product quality.

ILLUSTRATIVE PROBLEM I

The Flow Form Corporation uses a process costing system to account for the manufacture of counter tops. All materials are added at the start of production in the forming department. After production in the forming department is complete, the product travels to the finishing department for further work prior to being sent to the finished goods area.

Information concerning the Forming Department is listed below:

Costs on Beginning Work in Process	
Materials	$12,960
Conversion	$ 8,553
Current Month Costs	
Materials	$185,040
Conversion	$277,680
Quantities	
Beginning Work in Process	1,500 units
Starts in Production	21,000 units
Transferred Out to Next Dept	21,500 units
Ending Work in Process	1,000 units
State of Completion	
Beginning Work in Process	
Materials	100%
Labour	20%
Ending Work in Process	
Materials	100%
Labour	40%

Instructions

1. Prepare a Cost of Production Report for the forming department for the month of May 2000, assuming the company uses the weighted average cost method of accounting for production costs.
2. Prepare a Cost of Production Report for the forming department for the month of May 2000, assuming the company uses the first-in, first-out (FIFO) cost method of accounting for production costs.

Solution

1.

Flow Form Corporation
Cost of Production Report—Forming Department
for the Month of May 2000

		Equivalent Units	
Units Charged to Production		Materials	Conversion
Inventory in process, May 1	1,500		
Received into process	21,000		
	22,500		
Units to Be Assigned Costs			
Inventory in process, May 1	1,500	1,500	1,500
Completed inventory in process	20,000	20,000	20,000
Transferred Out	21,500	21,500	21,500
Inventory of Work in Process, May 31	1,000	1,000	400
	22,500	22,500	21,900

Units Costs	Materials	Conversion	Total
Total Costs for May in Forming			
Opening Work in Process	12,960	8,553	21,513
Costs in May	185,040	277,680	462,720
Total Costs to Apply	198,000	286,233	484,233
Divided by Total Equivalent Units	22,500	21,900	
Costs Charged to E.U.P.	$8.80	$13.07	
Costs Charged into Production			
Units Transferred Out	21,500	21,500	
	× 8.8	× 13.07	
	189,200	281,005	470,205
Cost Charged to Ending Work in Process	1,000	400	
	× 8.80	× 13.07	
	8,800	5,228	14,028
			484,233

2.

Flow Form Corporation
Cost of Production Report - Forming Department
for the Month of May 2000

		Equivalent Units	
Units Charged to Production		Materials	Conversion
Inventory in process, May 1	1,500		
Received into process	21,000		
	22,500		
Units to Be Assigned Costs			
Inventory in process, May 31	1,500	0	1,200
Started and Completed in May	20,000	20,000	20,000
Transferred Out	21,500	20,000	21,200
Inventory of Work in Process, May 31	1,000	1,000	400
	22,500	21,000	21,600

Units Costs	Materials	Conversion	Total
Total Costs for May in Forming			
Costs in May	185,040	277,680	
Divided by Total Equivalent Units	22,500	21,900	
Costs Charged to E.U.P.	$ 8.81	$ 12.86	
Costs Charged to Production			
Work in Process, May 1			21,513
Cost in May			462,720
Total Costs			484,233
Cost Allocated to Complete Beginning Work in process			
Inventory in Process			21,513
To Complete		15,432(a)	15,432
			433,334
Starts and Completion	176,200(b)	257,200(c)	433,400*
Ending Work in Process, May 31	8,810(d)	5,144(e)	13,654
Total Cost Charged to Production			484,233(F)
*Adjusted for Rounding $66			

Calculations

a. 1,200 × 12.86 = 15,432

To complete Conversion costs on beginning work in process.

b. 2,000 × 8.81 = 176,200

Materials costs for starts and completion.

c. 20,000 × 12.86 = 257,200

Conversion costs on starts and completion.

d. 1,000 × 8.81 = 8,810

Materials cost on ending work in process.

e. 400 × 12.86 = 5,144

Conversion costs on ending work in process.

f. When you originally add up the factors of the costs allocated, they look as follows:

21,513 + 15,432 + 433,400 + 13,594 = 484,299

This figure is $66 too large. The reason for this difference is in the fact that the cost per E.U.P. for materials and conversion were in fact rounded. When we round either up or down, the sum of the factors of the costs allocated will be either slightly smaller or larger than the correct amount.

This amount is then adjusted to the start and completion. As you will note, the original amount was in fact 433,400 and was later adjusted $66 to make the report balance and became 433,334.

In manufacturing, different companies will round to a different number of digits past the decimal, but nonetheless all companies will round the data. When there is rounding of E.U.P. costs, rounding is required.

ILLUSTRATIVE PROBLEM II

Tate Company manufactures Product A by a series of four processes, all materials being introduced in Department 1. From Department 1, the materials pass through Departments 2, 3, and 4, emerging as finished Product A. All inventories are costed by the first-in, first-out method.

The balances in the accounts Work in Process—Department 4 and Finished Goods were as follows on May 1:

Work in Process—Department 4 (1,000 units, 1/4 completed)	$17,800
Finished Goods (1,800 units at $23.50 a unit)	42,300

The following costs were charged to Work in Process—Department 4 during May:

Direct materials transferred from Department 3: 4,700 units at $16 a unit	$75,200
Direct labour	25,500
Factory overhead	15,300

During May, 5,000 units of A were completed and 4,800 units were sold. Inventories on May 31 were as follows:

Work in Process—Department 4: 700 units, 1/2 completed
Finished Goods: 2,000 units

Instructions: Determine the following:

1. Equivalent units of production for Department 4 during May.
2. Unit conversion cost for Department 4 for May.
3. Total and unit cost of Product A started in a prior period and finished in May.
4. Total and unit cost of Product A started and finished in May.
5. Total cost of goods transferred to finished goods.
6. Work in process inventory for Department 4, May 31.
7. Cost of goods sold (indicate number of units and unit costs).
8. Finished goods inventory, May 31.

Solution

1. Equivalent units of production:

To process units in inventory on May 1 (1,000 units x 3/4)	750
To process units started and completed in May (5,000 units - 1,000 units)	4,000
To process units in inventory on May 31 (700 units x 1/2)	350
Equivalent units of production in May	5,100

2. Unit conversion cost $= \dfrac{\$25{,}500 + \$15{,}300}{5{,}100}$

$= \$8$

3. Cost of Product A started in a prior period and finished in May:

1,000 units:	Inventory on May 1, 1/4 completed	$17,800
	Conversion cost in May (750 × $8)	6,000
	Total	$23,800
	Unit cost: $23,800 / 1,000 = $23.80	

4. Cost of Product A started and finished in May:

4,000 units:	Materials from Department 3 (4,000 x $16)	$64,000
	Conversion cost in May (4,000 × $8)	32,000
	Total	$96,000
	Unit cost: $96,000 / 4,000 = $24	

5. Total cost of goods transferred to finished goods:

Cost of Product A started in a prior period and finished in May (1,000 units at $23.80)	$ 23,800
Cost of Product A started and finished in May (4,000 units at $24)	96,000
Total	$119,800

6. Work in process inventory, May 31:

700 units: Materials cost (700 x $16)	$ 11,200
Conversion costs in May (350 x $8)	2,800
Work in process inventory, May 31	$ 14,000

7. Cost of goods sold:

1,800 units at $23.50	$ 42,300
1,000 units at $23.80	23,800
2,000 units at $24.00	48,000
4,800 units	$114,100

8. Finished goods inventory, May 31:

2,000 units at $24 = $48,000

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A. Conversion costs
B. Conversion cost per unit
C. Cost of production report
D. Ending inventory
E. Equivalent units of production
F. First-in, first-out (FIFO) cost method
G. Job order cost system
H. Just-in-time processing
I. Kanban
J. Manufacturing cells
K. Process cost system
L. Process manufacturers
M. Whole units
N. Weighted average costing
O. Yield

_____ 1. A cost accounting system in which costs are charged to processing departments, and the cost of the finished unit is determined by dividing total cost incurred in each process by the number of units produced.

_____ 2. Direct labour and factory overhead are referred to as (?).

_____ 3. The number of units that could have been completed within a given accounting period.

_____ 4. A report which summarizes for a department the units for which the department is accountable and the disposition of those units, and the costs incurred by the department and the allocation of those costs.

_____ 5. Direct labour and factory overhead per equivalent unit.

_____ 6. A processing approach that focuses on reducing time and cost and eliminating poor quality within the manufacturing process.

_____ 7. Measures the ratio of the materials output quantity to the materials input quantity.

_____ 8. A method of inventory costing that assumes the unit product costs should be determined separately for each period in the order in which the costs were incurred.

_____ 9. Manufacturers that use machines to process a continuous flow of raw materials through various stages of completion into a finished state.

_____ 10. Cards which contain information which communicates a work centre's need for material in a just-in-time processing system.

_____ 11. The number of units in production during a period, whether or not completed.

_____ 12. Work centres in a just-in-time system where processing functions are combined.

_____ 13. A method of costing that calculates beginning work in process costs and current month costs to arrive at an average cost.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

		True	False
1.	The number of units that could have been completed within a given accounting period is referred to as the equivalent units of production.	_____	_____
2.	A report prepared periodically for each processing department and which summarizes (a) the units for which the department is accountable and the disposition of those units and (b) the production costs incurred by the department and the allocation of those costs is called a cost of production report.	_____	_____
3.	The accumulated costs transferred from preceding departments and the costs of direct materials and direct labour incurred in each processing department are debited to the related work in process accounts.	_____	_____
4.	The most important use of the cost of production report is to schedule production..	_____	_____
5.	Multiple material inputs may require equivalent unit and cost per equivalent unit computations for each input	_____	_____
6.	The equivalent units of production should be used to allocate department costs when the product type varies from batch to batch..	_____	_____
7.	A cost of production report will normally list costs in greater detail to help management isolate problems and opportunities.	_____	_____
8.	The cost of production report should only be prepared to show costs within a department for a particular month.	_____	_____
9.	If the material is introduced halfway through processing and the beginning inventory is 40% complete, then the equivalent units for beginning inventory will be zero assuming FIFO).	_____	_____
10.	The first-in, first-out cost method is based on the assumption that the work in process at the beginning of the current period was started and completed during the current period.	_____	_____
11.	If the work in process at the beginning of the period is 400 gallons, 1,600 gallons were started during the period, and 300 gallons remained in process at the end of the period, then the units started and completed are 1,700 gallons.	_____	_____
12.	An industry that commonly uses process cost systems is the custom-made tailoring industry..	_____	_____
13.	Weighted average costing is superior to first-in, first-out costing.	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. In the manufacture of 10,000 equivalent units of product for a period, direct materials cost incurred was $200,000, direct labour cost incurred was $75,000, and applied factory overhead cost was $185,000. What was the unit conversion cost for the period assuming first-in, first-out costing?
   a. $7.50
   b. $18.50
   c. $26
   d. $46

2. The Finishing Department had 6,000 units, 1/3 completed at the beginning of the period; 16,000 units were transferred to the Finishing Department from the Sanding Department during the period; and 2,500 units were 1/5 completed at the end of the period. What is the total units to be accounted for on the cost of production report for the Finishing Department for the period, assuming FIFO costing?
   a. 13,500
   b. 15,500
   c. 18,500
   d. 22,000

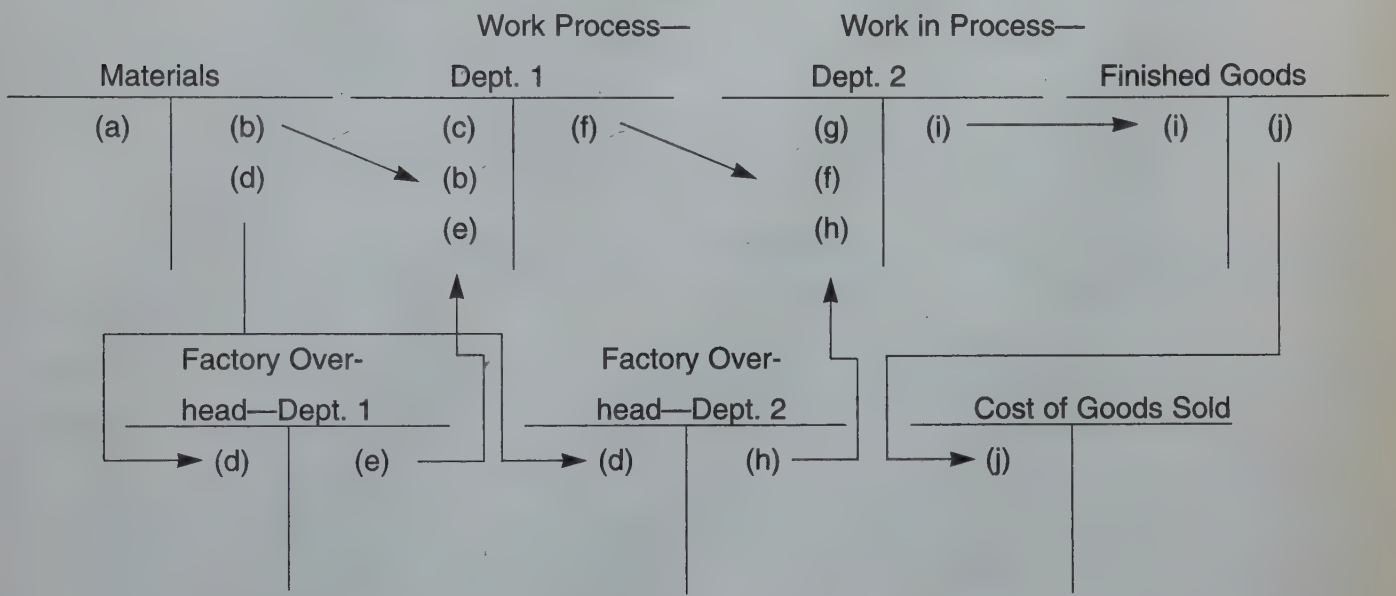
3. Material B is added after the processing is 60% completed. There were 2,400 units completed during the period. There were 300 units in beginning inventory (50% completed), and 100 units in process at the end of the period (20% completed). What was the total equivalent units of production for Material B, assuming FIFO, costing?
   a. 2,400
   b. 2,200
   c. 2,500
   d. 2,700

4. If the Weaving Department had 900 units, 40% completed, in process at the beginning of the period, 9,000 units were completed during the period, and 600 units were 10% completed at the end of the period, what was the number of conversion equivalent units of production for the period, using the FIFO cost method?
   a. 8,520
   b. 8,700
   c. 8,900
   d. 9,060

5. If the Converting Department processed two different products, A and B, and product A took twice as long to convert as did product B, then the following would be true:
   a. Process costing should not be used.
   b. Costs should not be allocated using equivalent units of production.
   c. The cost of production report should be prepared for two departments.
   d. The average cost method should be used.
6. Stratifying the cost of production report by product, process, or shift is useful for:
   a. scheduling production.
   b. controlling employees.
   c. identifying underlying causes of cost influences.
   d. valuing inventory more accurately.

Exercise 19–1

Instructions: Presented below is a diagram of the cost flows for Cortex Company, a process manufacturer. Cortex has two processing departments. All materials are placed into production in Department 1. In the spaces beneath the diagram identify each letter contained in the diagram.



(a) _____

(b) _____

(c) _____

(d) _____

(e) _____

(f) _____

(g) _____

(h) _____

(i) _____

(j) _____

EXERCISE 19–2

Ellis Company started April with 12,000 units in process that were 30% complete at a cost of $32,600. During April, the following costs were incurred: direct materials, $148,800; direct labour, $141,000; and factory overhead, $185,400. During April, 66,000 units were completed and transferred to finished goods. There were 8,000 units in process that were 20% completed at April 30. All materials are added at the beginning of the production process and conversion costs are incurred evenly throughout.

Instructions: Use the work sheet presented below to determine the following:

(1) Equivalent units of production for materials costs . . . . . _____

(2) Equivalent units of production for conversion costs . . . . . _____

(3) Conversion cost per equivalent unit . . . . . $ _____

(4) Material cost per equivalent unit . . . . . $ _____

(5) Work in process inventory, April 30 . . . . . $ _____

(6) Cost of goods transferred to finished goods warehouse . . . . $ _____

Units	Total Whole Units	% Material to Be Completed in April	% Conversion to Be Completed in April	**(1)** Equivalent Units for Materials	**(2)** Equivalent Units for Conversion

Costs	**(3)** Direct Materials	**(4)** Conversion Costs	Total
(6)			
(5)			

PROBLEM 19–1

Mirror Inc. is a small manufacturing company that uses a process cost accounting system. The firm has two processing departments.

Instructions: Record the following transactions in the journals provided. Any indirect cost such as indirect labour or indirect material incurred by a department should be charged to the department's overhead account. (Omit dates and explanations.)

(1) Materials purchased on account, $210,000.

(2) The following materials were requisitioned: Department 10, direct, $18,000; Department 10, indirect, $2,100; Department 20, direct, $24,000; Department 20, indirect, $600.

(3) The labour used by factory departments was: Department 10, direct, $25,000; Department 10, indirect, $2,700; Department 20, direct, $20,000; Department 20, indirect, $2,700.

(4) The following other costs and expenses were incurred on account: factory overhead, Department 10, $1,500; factory overhead, Department 20, $2,250.

(5) Amortization expenses were: Department 10, $4,200; Department 20, $3,150.

(6) Factory overhead costs were applied to work in process on the basis of 102% of the direct labour cost of Department 10 and 75% of the direct labour cost of Department 20. (See Transaction 3.)

(7) There was no beginning or ending inventory in Department 10. All costs accumulated in Department 10 work in process were transferred to Department 20.

(8) The work in process in Department 20 at the end of the period amounted to $12,500. The balance (representing 20,000 units) was transferred to finished goods. (There was no beginning inventory of work in process.)

(9) Sales of 21,000 units for $160,000 on account were made during the month. The cost of goods sold was $122,000.

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PROBLEM 19–2

Instructions: Prepare a cost of production report for the Polishing Department of Ivy Inc. for March of the current fiscal year, using the FIFO cost method and the following data:

Inventory, March 1, 5,000 units, 30% completed	$ 37,025
Materials from the Cutting Department, 21,000 units	105,000
Direct labour for March	176,140
Factory overhead for March	120,000
Inventory, March 31, 6,000 units, 60% completed	—

Ivy Inc.

Cost of Production Report—Polishing Department

For the Month Ended March 31, 20—

UNITS	WHOLE UNITS	EQUIVALENT UNITS	
		DIRECT MATERIALS	CONVERSION

Ivy Inc.

Cost of Production Report—Polishing Department (Concluded)

For the Month Ended March 31, 20—

COSTS	COSTS		
	DIRECT MATERIALS	CONVERSION	TOTAL COSTS

20 Cost Behaviour and Cost-Volume-Profit Analysis

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 20.

1. Many new terms are introduced in this chapter. You can expect true/false, multiple-choice, or matching questions testing your knowledge of these terms. Study the Key Terms to prepare for such questions.
2. Expect some multiple-choice questions related to the behaviour of costs. For example, you might be required to classify various types of costs (direct materials, for example) as variable, fixed, or mixed for the activity of units produced. You might also have to use the high-low method to separate a mixed cost into its variable and fixed costs components.
3. The major focus of this chapter is the computation of break-even sales (units) and sales (units) required to achieve a target profit. These computations are based upon the contribution margin concept. In your studying, focus on the mathematical approach to cost-volume-profit analysis. Instructors often do not require preparation of a cost-volume-profit or a profit-volume chart.
4. The special cost-volume-profit relationships (margin of safety and operating leverage) and the assumptions of cost-volume-profit analysis often appear in the form of true/false or multiple-choice questions on tests.

CHAPTER OUTLINE

I. Cost Behaviour.

- **A.** Cost behaviour refers to the manner in which a cost changes as a related activity changes.
- **B.** Two cost-related factors must be considered to understand the behaviour of a cost.
  1. Activities that are thought to cause the incurrence of the cost must be identified; such activities are called activity bases (drivers).
  2. The range of activity over which the changes in the cost will be analyzed, called the relevant range, must be specified.

C. Three of the most common ways in which costs are classified by behaviour include variable costs, fixed costs, and mixed costs.

D. Variable costs are costs that vary in total in proportion to changes in the level of activity.

1. When the level of activity is units produced, direct materials and direct labour costs are generally classified as variable costs.
2. Variable costs are constant per unit, while the total variable cost changes in proportion to changes in the activity base.
3. Exhibit 1 in the chapter illustrates how the direct materials variable costs behave in total and on a per-unit basis as production changes.

E. Fixed costs are costs that remain the same in total dollar amount as the level of activity changes.

1. When units produced is the measure of activity, examples of fixed manufacturing costs include straight-line amortization of factory equipment, insurance on factory plant and equipment, and salaries of factory supervisors.
2. Exhibit 2 in the chapter illustrates how the fixed manufacturing costs behave in total and on a per-unit basis as production changes.

F. A mixed cost has characteristics of both a variable and a fixed cost.

1. Over one range of activity, the total mixed cost may remain the same, thus behaving as a fixed cost.
2. Over another range of activity, the mixed cost may change in proportion to change in the level of activity, thus behaving as a variable cost.
3. Mixed costs are sometimes referred to as semivariable or semifixed costs.
4. Exhibit 3 of the chapter illustrates mixed cost behaviour.
5. In practice, mixed costs are usually separated into their fixed and variable components for management analysis. The high-low method is a cost estimation technique that may be used for this purpose.
6. The high-low method uses the highest and the lowest activity levels and their related costs to estimate the variable cost per unit and the fixed cost component of mixed costs.
7. The variable cost per unit is estimated using the following formula:

$$\text{Variable Cost per Unit} = \frac{\text{Difference in Total Cost}}{\text{Difference in Production}}$$

8. The fixed cost will be the same at both the highest and lowest production levels. The fixed cost component can be estimated by subtracting the estimated total variable cost from the total cost, using the following total cost equation:

$$\text{Total Cost} = \text{Variable Cost per Unit} \times \text{Units of Production} + \text{Fixed Cost}$$

G. The cost behaviour of variable and fixed costs can be summarized as follows:

1. Total variable costs vary proportionally with the activity level.
2. Unit variable costs remain the same regardless of the activity level.
3. Total fixed costs remain the same regardless of the activity level.
4. Unit fixed costs vary inversely with the activity level.

H. One method of reporting variable and fixed costs for management decision making purposes is variable costing or direct costing.

1. Under variable costing, only the variable manufacturing costs (direct materials, direct labour, and variable factory overhead) are included in product cost.
2. Fixed factory overhead is reported as an expense of the period in which it is incurred.

II. Cost-Volume-Profit Relationships.

A. Cost-volume-profit analysis is the systematic examination of relationships among selling prices, sales and production volume, costs, expenses, and profits.

B. The contribution margin is the excess of sales revenues over variable costs. The deduction of fixed costs from the contribution margin yields the operating income or loss.

C. The contribution margin can also be expressed as a percentage. The contribution margin ratio, sometimes called the profit-volume ratio, indicates the percentage of each sales dollar available to cover fixed costs and to provide operating income.

D. The contribution margin ratio measures the effect of an increase or a decrease in sales volume on operating income.

E. The contribution margin ratio is also useful in setting business policy. If a firm's contribution margin ratio is large (small), a comparatively large (small) increase or decrease in operating income can be expected from a change in sales volume.

F. The unit contribution margin is the dollars available from each unit of sales to cover fixed costs and provide operating profits. The unit contribution margin is most useful when the increase or decrease in sales volume is measured in sales units (quantities).

III. Mathematical Approach to Cost-Volume-Profit Analysis.

A. The mathematical approach to cost-volume-profit analysis uses equations (1) to determine the units of sales necessary to achieve the break-even point in operations or (2) to determine the units of sales necessary to achieve a target or desired profit.

B. The level of operations at which a business's revenues and expired costs are exactly equal is called the break-even point.

C. The break-even sales in units can be computed using the following equation:

$$\text{Break-Even Sales (Units)} = \frac{\text{Fixed Costs}}{\text{Unit Contribution Margin}}$$

D. The break-even point is affected by changes in the fixed costs, unit variable costs, and the unit selling price.

1. Increases in fixed costs will raise the break-even point. Similarly, decreases in fixed costs will lower the break-even point.
2. Increases in unit variable costs will raise the break-even point. Similarly, decreases in unit variable costs will lower the break-even point.
3. Increases in the unit selling price will lower the break-even point, while decreases in the unit selling price will raise the break-even point.

E. By modifying the break-even equation as shown below, the sales volume required to earn a target or desired amount of profit may be estimated.

$$\text{Sales (Units)} = \frac{\text{Fixed Costs} + \text{Target Profit}}{\text{Unit Contribution Margin}}$$

IV. Graphic Approach to Cost-Volume-Profit Analysis.

A. Cost-volume-profit analysis can be presented both graphically and in equation form.

B. A cost-volume-profit chart, sometimes called a break-even chart, is constructed in the following manner:

1. Volume expressed in units of sales is indicated along the horizontal axis. The range of volume shown on the horizontal axis should reflect the relevant range in which the business expects to operate. Dollar amounts representing total sales and costs are indicated along the vertical axis.
2. A sales line is plotted by beginning at zero on the left corner of the graph. A second point is determined by multiplying any units of sales on the horizontal axis by the unit sales price.
3. A cost line is plotted by beginning with total fixed costs on the vertical axis. A second point is determined by multiplying any units of sales on the horizontal axis by the unit variable costs and adding the fixed costs. The cost line is drawn upward to the right from the total fixed costs through the second cost point.
4. Horizontal and vertical lines are drawn at the point of intersection of the sales and cost lines, which is the break-even point, and the areas representing operating profit and operating loss are identified.

C. Changes in the unit selling price, total fixed costs, and unit variable costs can also be analyzed using a cost-volume-profit chart.

D. A second graphic approach, the profit-volume chart, focuses only on profits by plotting only the difference between total sales and total costs or profits.

E. A profit-volume chart is constructed in the following manner:

1. Volume expressed in units of sales is indicated along the horizontal axis. The range of volume shown on the horizontal axis should reflect the relevant range in which the business expects to operate. Dollar amounts indicating operating profits and losses are shown along the vertical axis.
2. A point representing the maximum operating loss is plotted on the vertical axis at the left. This loss is equal to total fixed costs at the zero level of sales.
3. A point representing the maximum operating profit within the relevant range is plotted on the right.
4. A diagonal profit line is drawn connecting the maximum operating loss point with the maximum operating profit point.
5. The profit line intersects the horizontal axis at the break-even point expressed in units of sales, and the areas indicating operating profit and loss are identified.

F. The effect of changes in the unit selling price, total fixed costs, and unit variable costs on profit can be analyzed using a profit-volume chart.

G. Both the graphic and mathematical approaches are becoming increasingly popular and easy to use since most managers have access to computer terminals or microcomputers.

H. With the computer software that is available, managers can vary assumptions regarding selling prices, costs, and volume and can immediately analyze the effects of each assumption on the break-even point and profit. Such an analysis is called the "what if" or sensitivity analysis.

V. Sales Mix Considerations.

A. The sales mix is the relative distribution of sales among the various products sold by a business. The sales mix can be expressed as a relative percentage of sales among products.

B. To compute the break-even point when several products are sold, it is useful to think of the individual products as components of one overall product, C.

1. The unit selling price of C can be thought of as equal to the total of the unit selling prices of the individual products multiplied by their sales mix percentages.
2. The unit variable cost of C can be thought of as equal to the total of the unit variable costs of the individual products multiplied by the sales mix percentages.

3. The unit contribution margin of C can be thought of as equal to the total of the unit contribution margins of the individual products multiplied by the sales mix percentages.

C. The break-even point of C can be determined in the normal manner.

D. The sales mix percentages can be used to determine the sales of each product at the break-even point.

E. The effects of changes in the sales mix on the break-even point can be determined by repeating the preceding analysis, assuming a different sales mix.

VI. Special Cost-Volume-Profit Relationships.

A. The difference between the current sales revenue and the sales at the break-even point is called the margin of safety.

1. The margin of safety is computed as a percentage using the following formula.

$$\text{Margin of Safety} = \frac{\text{Sales - Sales at Break-Even Point}}{\text{Sales}}$$

2. The margin of safety can be expressed in dollars, units, or as a percentage of sales.

B. Operating leverage is a measure of the relative mix of a business's variable costs and fixed costs.

1. Operating leverage is computed by measuring the relationship between contribution margin and operating income, as follows:

$$\text{Operating Leverage} = \frac{\text{Contribution Margin}}{\text{Operating Income}}$$

2. Managers can use operating leverage to measure the impact of changes in sales on operating income. A high (low) operating leverage indicates that a small (large) increase in sales will yield a large percentage increase in operating income.

VII. Assumptions of Cost-Volume-Profit Analysis.

A. The reliability of cost-volume-profit analysis depends upon the validity of the following assumptions:

1. Total sales and total costs can be represented by straight lines.
2. Within the relevant range of operating activity, the efficiency of operations does not change.
3. Costs can be accurately divided into fixed and variable components.
4. The sales mix is constant.
5. There is no change in the inventory quantities during the period.

B. Since the above assumptions are frequently valid for the relevant range of operations under consideration, cost-volume-profit analysis is often used effectively in managerial decision making.

ILLUSTRATIVE PROBLEM

Johnson Inc. expects to maintain the same inventories at the end of the year as at the beginning of the year. The estimated fixed costs for the year are $360,000, and the estimated variable costs per unit are $9. It is expected that 75,000 units will be sold at a price of $15 per unit. Maximum sales within the relevant range are 80,000 units.

Instructions

1. What is (a) the contribution margin and (b) the unit contribution margin?
2. Determine the break-even point in units.
3. Construct a cost-volume-profit chart, indicating the break-even point.
4. Construct a profit-volume chart, indicating the break-even point.
5. What is the margin of safety?

Solution

1. **a.** Contribution Margin Ratio $= \dfrac{\text{Sales - Variable Costs}}{\text{Sales}}$

$$\text{Contribution Margin Ratio} = \frac{(75{,}000 \text{ units} \times \$15) - (75{,}000 \text{ units} \times \$9)}{(75{,}000 \text{ units} \times \$15)}$$

$$\text{Contribution Margin Ratio} = \frac{\$1{,}125{,}000 - \$675{,}000}{\$1{,}125{,}000} = \frac{\$450{,}000}{\$1{,}125{,}000}$$

Contribution Margin Ratio = 40%

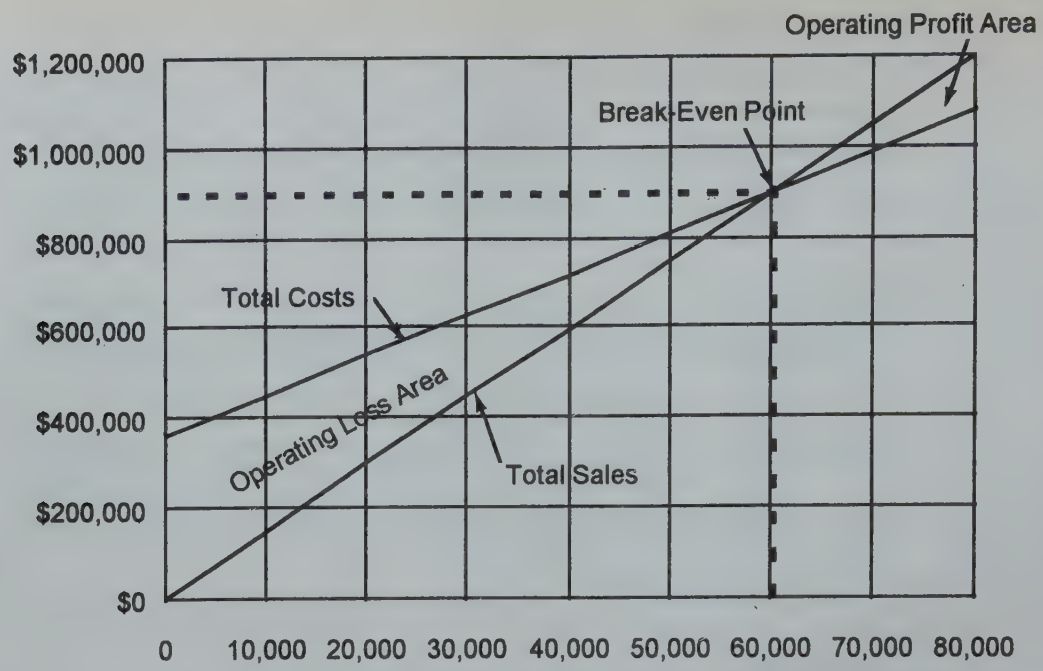
b. Unit Contribution Margin = Unit Selling Price – Unit Variable Costs

Unit Contribution Margin = $15 – $9 = $6

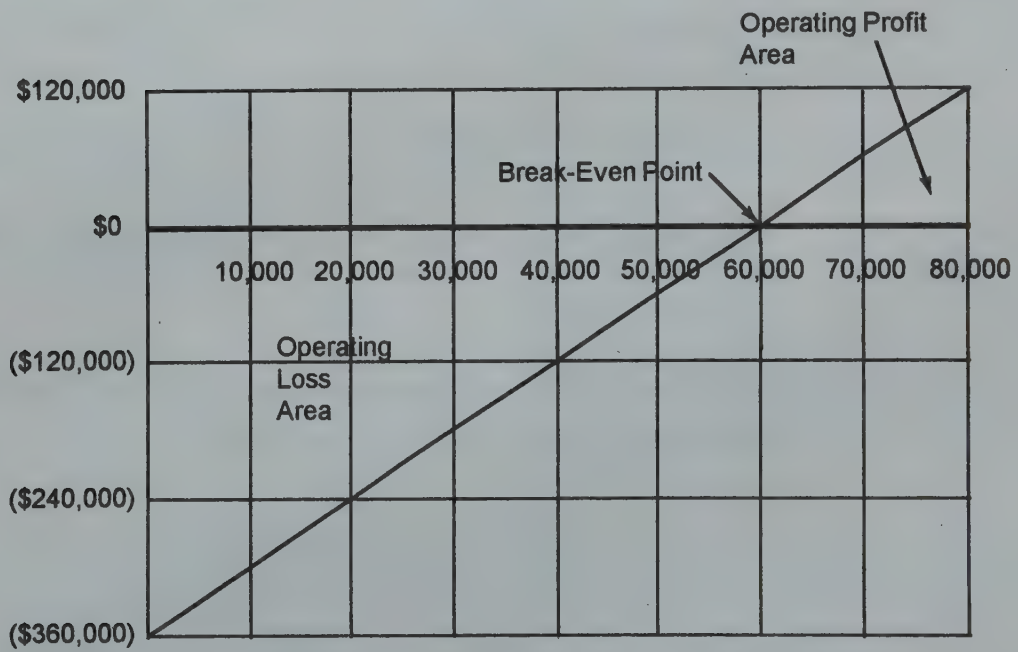
2. Break-Even Sales (Units) $= \dfrac{\text{Fixed Costs}}{\text{Unit Contribution Margin}}$

$$\text{Break-Even Sales (Units)} = \frac{\$360{,}000}{\$6} = 60{,}000 \text{ units}$$

3.



4.



5. Margin of Safety:

Expected sales (75,000 units × $15)	$1,125,000
Break-even point (60,000 units × $15)	900,000
Margin of safety	$ 225,000

OR

$$\text{Margin of Safety} = \frac{\text{Sales - Sales at Break-Even Point}}{\text{Sales}}$$

$$\text{Margin of Safety} = \frac{\$225,000}{\$1,125,000} = 20\%$$

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A. Activity bases (drivers)
B. Break-even point
C. Contribution margin
D. Contribution margin ratio
E. Cost behaviour
F. Cost-volume-profit analysis
G. Cost-volume-profit chart
H. Fixed costs
I. High-low method
J. Margin of safety
K Mixed cost
L. Operating leverage
M. Profit-volume chart
N. Relevant range
O. Sales mix
P. Unit contribution margin
Q. Variable costing
R. Variable costs

_____ 1. Refers to the manner in which a cost changes in relation to its activity driver.

_____ 2. Costs that vary in total in dollar amount as the level of activity changes.

_____ 3. Costs that tend to remain the same in amount, regardless of variations in the level of activity.

_____ 4. The range of activity over which changes in cost are of interest to management.

_____ 5. A cost estimation method which uses two points to estimate the variable cost per unit and the fixed cost component of a mixed cost.

_____ 6. The systematic examination of the relationships among selling prices, volume of sales and production, costs, expenses, and profits.

_____ 7. The level of business operations at which revenues and expired costs are equal.

_____ 8. A chart used to assist management in understanding the relationships among costs, expenses, sales, and operating profit or loss.

_____ 9. A chart used to assist management in understanding the relationship between profit and volume.

_____ 10. The relative distribution of sales among the various products available for sale.

_____ 11. The difference between the current sales revenue and the sales at the break-even point.

_____ 12. The percentage of each sales dollar that is available to cover the fixed costs and to provide operating income.

_____ 13. A measure of the relative mix of a business's variable costs and fixed costs, computed as contribution margin divided by operating income.

_____ 14. A measure of activity that is thought to cause the incurrence of cost.

_____ 15. A cost with both variable and fixed characteristics.

_____ 16. The dollars available from each unit of sales to cover fixed costs and provide operating profits.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

		True	False
1.	Per unit fixed costs change with proportional changes in the activity driver.	_____	_____
2.	Most operating decisions by management focus on a range of activity, known as the relevant range, within which management plans to operate.	_____	_____
3.	Mixed costs, sometimes referred to as semi-variable or semi-fixed costs, are costs that have both variable and fixed characteristics	_____	_____
4.	Mixed costs are classified as variable costs.	_____	_____
5.	The high-low method can be used to estimate the fixed cost and variable cost components of a mixed cost. . .	_____	_____
6.	Using the high-low method, the fixed costs will differ at the highest and lowest levels of production.	_____	_____
7.	For a cost-volume-profit analysis, all costs should be subdivided into two categories: fixed and variable. . . .	_____	_____
8.	The point in the operations of a business at which revenues and expired costs are equal is called the break-even point.	_____	_____
9.	The data required to compute the break-even point are (1) total estimated fixed costs for a future period, and (2) the unit contribution margin.	_____	_____
10.	Increases in unit variable costs will increase the break-even point.	_____	_____
11.	Decreases in the unit selling price will decrease the break-even point.	_____	_____
12.	Decreases in fixed costs will increase the break-even point.	_____	_____
13.	The profit-volume chart focuses on profitability by plotting on a graph the total sales and total costs. . . .	_____	_____
14.	Under variable costing, fixed factory overhead is included in the product cost.	_____	_____
15.	A major assumption of cost-volume-profit analysis is that the quantity of units in the beginning inventory is equal to the quantity of units in the ending inventory.	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. Which of the following statements describes fixed costs?
   - **a.** costs that remain constant on a per unit basis as the activity base changes
   - **b.** costs that vary in total in direct proportion to changes in the activity base
   - **c.** costs that remain constant on a per unit basis, but vary in total as the activity level changes
   - **d.** costs that remain constant in total dollar amount as the level of activity changes
2. What term is used to describe a cost which has characteristics of both a variable and fixed cost?
   - **a.** variable cost
   - **b.** fixed cost
   - **c.** mixed cost
   - **d.** sunk cost
3. If Berkson Inc.'s costs at 150,000 units of production are $240,000 (the high point of production) and $152,500 at 80,000 units of production (the low point of production), the variable cost per unit using the high-low method of cost estimation is:
   - **a.** 0
   - **b.** $1.25
   - **c.** $1.60
   - **d.** $1.91
4. Which of the following changes would have the effect of increasing the break-even point for a business?
   - **a.** a decrease in fixed costs
   - **b.** a decrease in unit variable cost
   - **c.** a decrease in unit selling price
   - **d.** none of the above
5. Which of the following costs will be classified as a fixed cost in cost-volume-profit analysis?
   - **a.** direct materials
   - **b.** real estate taxes
   - **c.** direct labour
   - **d.** supplies

6. If the contribution margin is $16 and fixed costs are $400,000, what is the break-even point in units?
   a. 25,000
   b. 250,000
   c. 400,000
   d. 6,400,000
7. If sales are $300,000 and sales at the break-even point are $250,000, what is the margin of safety?
   a. 17%
   b. 20%
   c. 83%
   d. 120%
8. If for Jones Inc. the contribution margin is $200,000 and operating income is $40,000, what is the operating leverage?
   a. 240,000
   b. 160,000
   c. 5
   d. .4

EXERCISE 20–1

Data for the highest and lowest levels of production for Evans Company are as follows:

	Total Costs	Total Units Produced
Highest level	$550,000	50,000 units
Lowest level	$250,000	20,000

Instructions

(1) Determine the differences between total costs and total units produced at the highest and lowest levels of production.

(2) Using the high-low method of cost estimation, estimate the variable cost per unit and the fixed cost for Evans Company.

(3) Based on (2), estimate the total costs for 80,000 units of production.

EXERCISE 20–2

Instructions: Name the following chart and identify the items represented by the letters *a* through *f*.

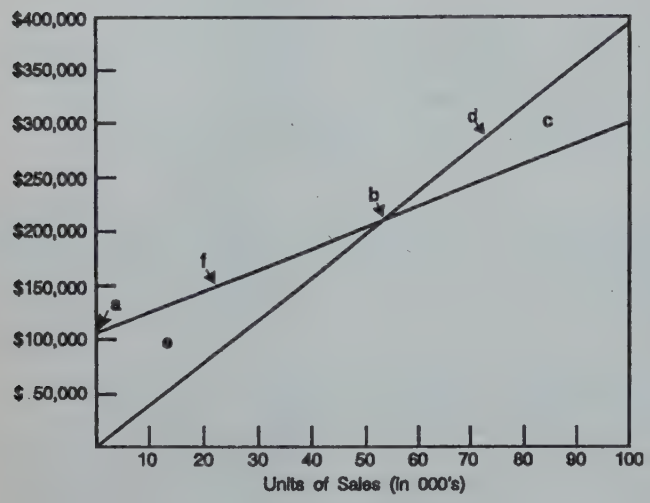


Chart _____

(a) _____

(b) _____

(c) _____

(d) _____

(e) _____

(f) _____

EXERCISE 20–3

Instructions: In each of the following cases, use the appropriate formula (margin of safety or operating leverage ratio) to determine the answer.

(1) Sales are $2,000,000.

Break-even sales would be $1,700,000.
The margin of safety as a percentage of sales is . . . . . _____ %

(2) Sales are $150,000.

Break-even sales would be $100,000
The margin of safety as a percentage of sales is . . . . . _____ %

(3) Operating income is $175,000.

The contribution margin is $300,000.
The operating leverage is . . . . . _____

(4) Sales are $700,000.

Variable costs are $300,000.
Operating income is $200,000.
The operating leverage is . . . . . _____

PROBLEM 20-1

Larson Co. produces telephone answering machines. At March 1, Larson estimates fixed costs related to production to be $700,000. The unit selling price, unit variable cost, and unit contribution margin for Larson Co. are as follows:

Unit selling price	$ 75
Unit variable cost	25
Unit contribution margin	$ 50

Instructions: Perform the following calculations assuming the facts given above unless otherwise indicated. (Round to the nearest dollar.)

(1) Calculate the break-even point in units for Larson Co.

(2) Assume Larson Co. is contemplating paying $2,000 more to each of five factory supervisors. What would the new break-even point be if such a plan was put into action?

(3) What would the break-even point be if the cost of direct materials increased by $1.00 per unit?

(4) What would the break-even point be if the selling price increased to $77 per telephone answering machine?

(5) What is the sales volume necessary to earn a target profit of $300,000?

PROBLEM 20-2

Data related to the expected sales of products A and B for Galla Inc. for the current year, which is typical of recent years, are as follows.

Product	Selling Price per Unit	Variable Cost per Unit	Sales Mix
A	$180	$140	80%
B	$280	$190	20%

The estimated fixed costs for the current year are $400,000.

Instructions:

(1) Determine the estimated sales in units and dollars to reach the break-even point for the current year.

(2) Prove the validity of the answer in (1) by completing the following condensed income statement.

	Product A	Product B	Total
Sales:			
_____ units × $180	_____	_____	_____
_____ units × $280	_____	_____	_____
Total sales	_____	_____	_____
Variable costs:			
_____ units × $140	_____	_____	_____
_____ units × $190	_____	_____	_____
Total variable costs	_____	_____	_____
Contribution margin			_____
Fixed costs			_____
Operating profit			_____

21 Cost Allocation and Activity-Based Costing

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 21.

1. A few new terms are introduced in this chapter. You can expect true/false, multiple-choice, or matching questions testing your knowledge of these terms. Study the Key Terms to prepare for such questions.
2. The major emphasis of this chapter is cost allocation and the effect the choice of allocation technique will have on the costing of the product or service.
3. You should be able to compute three methods of allocation of factory overhead and identify the conditions favouring each method.
4. You should be able to explain why there has been growth in activity-based costing in recent years and how this area of costing will be expanding into the years to come.

CHAPTER OUTLINE

I. **Product Costing Allocation Methods**—are used to calculate the amount of overhead to be charged to a product to be manufactured. Product costing consists of direct materials, direct labour, and factory overhead. Factory overhead is applied to production based on an allocation method.

   A. The total costs of budgeted factory overhead for the upcoming year are estimated and this estimated cost is divided by the amount of activity we expect to have in the upcoming period. The activity is usually based on the number of labour hours, the amount of labour cost, or in the case of a mechanized operation, the number of machine hours used.

   B. Three methods of allocation are studied in this chapter:

      1. Single plantwide rate.
      2. Multiple production department rate.
      3. Activity-based costing method.

II. Single Plantwide Factory Overhead Rate Method.

A. A factory wide rate is calculated by taking the total budgeted factory overhead for the upcoming period and dividing this amount by the total amount of the total activity base of the factory. (This is the sum of all factory departments.)

$$\text{Application Rate} = \frac{\text{Total Budgeted Factory Overhead}}{\text{Total Budgeted Plant Activity Base}}$$

B. Advantages.

1. The advantage of this method is that it is simple to calculate and to administer.

C. Disadvantages.

1. The method assumes that all production is similar in the amount of work and the type of work required.

2. When the company produces different products that require unique inputs the method results in not accurately costing production.

III. Multiple Production Department Factory Overhead Rate Method.

A. Each department is treated as a unique entity. Costs are tracked to the operation of the department and an estimated factory overhead cost is calculated for the upcoming years. The amount of cost to run the department is then divided by the activity base that most matches the way the department operates (labour hours, labour cost, or machine hours). For example in a machine-oriented department the machine hours projected for the upcoming year should be the activity base. If the department is a labour-oriented area, an activity base that is labour-oriented should be used.

$$\text{Dept. Application Rate} = \frac{\text{Total Budgeted Dept. Cost}}{\text{Total Budgeted Activity Base}}$$

B. Advantages.

1. This method of cost allocation takes into account the fact that different departments within the company have varying costs to operate. The costing of the department when divided by the work done in the department provides a more accurate method of charging for the area than the factory wide rate.

C. Disadvantages.

1. The need to calculate different application rates for each department and to track the production's time in each department is more expensive than a factory wide rate.

IV. Distortion in Product Costs—Single Plantwide vs. Multiple Production Department Factory Overhead Rates.

A. If a department has more than one activity, the costing of the product receiving the lower cost activity will be the same as the product receiving the same amount of the higher cost activity.

B. The factor of departments having more than one activity area will cause an unfair costing to the production going through the department

V. Activity-Based Costing Method.

A. The plant is divided into activities rather than departments. Each activity has costs associated with its operations. The cost driver for the activity divides the budgeted cost of the operation for the upcoming year into an application rate.

$$\text{Activity Application Rate} = \frac{\text{Budgeted Cost of the Activity}}{\text{Budgeted Activity Base}}$$

B. This more refined costing will, in fact, divide activities that were once housed in a single department. This method of costing out overhead is important when there are different activities that have varying costs that could be in one department. For example, the grinding department could do very rough grinding on some job lots. This rough grinding is less expensive to complete. The cost of the fine-detailed grinding that is completed on other jobs is very expensive to provide. If a departmental rate for grinding is used, the jobs would be costed the same. The services received are, in fact, very different. This would unfairly cost the production.

C. Disadvantages.

1. The more activities identified in the factory, the more complex the cost tracking to activities and the administration of the application to production.
2. The application of this method of cost allocation is reliant on the activities being well thought out. The more activities are identified, the more accurate the system will be. There is, however, a point at which identifying more activities becomes too difficult and costly to administer.

D. Advantages.

1. Activity-based cost application for factory overhead will provide a very accurate application of costs to production. This method of costing is used in service-sector costing of services.

VI. Activity-Based Costing in Service Businesses.

A. Activity-based costing is valuable when costing not only production units for factory overhead in a manufacturing situation, but also when costing services. (The service sector accounts for more than 70% of the North American economy and is growing). Exhibit 11 on page 922 highlights such applications in the service sector.

B. Service businesses need to base the charge that is made to the customer accurately to account for the cost of rendering the service. Many other decisions such as pricing and promotion depend on the profitability of the service delivered.

ILLUSTRATIVE PROBLEM

A.B.C. Corporation manufactures two different products for the North American market. The production departments of the company are the Assembly, Grinding, and Finishing departments. The costs associated with the overhead of the areas are as follows:

Assembly	. . . . .	$400,000	Activity of rough framing	. . . . . $300,000
			Activity of finer framing	. . . . . $100,000

Rough framing consists of 100,000 hours of work completed for a budgeted year.
Finer framing consists of only 20,000 hours of work completed for a budgeted year.

Grinding	. . . . .	$500,000	Activity of rough grinding	. . . . . $250,000
			Activity of fine grinding	. . . . . $250,000

Rough grinding consists of 50,000 hours of work completed in a budgeted year.
Fine grinding consists of only 10,000 hours of work completed for a budgeted year.

Finishing	. . . . .	$800,000	Activity of rough finishing	 500,000
			Activity of fine finishing	. . . . . $300,000

Rough finishing consists of 200,000 hours of work completed in a budgeted year.
Fine finishing consists of 50,000 hours of work completed in a budgeted year.

Product WGB is manufactured in the current year and required 500 hours of fine framing, 450 hours of fine grinding, and 100 hours of fine finishing.

Product NMO is manufactured in the current year and required 200 hours of rough framing, 50 hours of rough grinding and 50 hours of rough finishing.

Instructions: For each of the product job lots, calculate the following:

a. The costs that would be applied using a factory-wide overhead rate.

b. The cost that would be applied using a departmental rate for overhead application.

c. The cost that would be applied when applying overhead at an activity-based rate.

d. Comment of which of the methods results in the most accurate costing of overhead and why.

Solution

a.

$$\frac{\$400{,}000 + 500{,}000 + 800{,}000}{120{,}000 + 60{,}000 + 250{,}000} = \frac{\$1{,}700{,}000}{430{,}000} = \$3.9534 \text{ or } \$3.95 \text{ per hour}$$

WGB = (500 + 450 + 100) × $3.95 = $4,147.50

NMO = (200 + 50 + 50) × $3.95 = $1,185.00

b.

Assembly Dept. $\frac{\$400{,}000}{60{,}000} = \$3.33$ per hour

Grinding Dept. $\frac{\$500{,}000}{120{,}000} = \$8.33$ per hour

Finishing Dept. $\frac{\$800{,}000}{250{,}000} = \$3.20$ per hour

WCG	Framing Department	= 500 × $3.33 = $1,665.00
	Grinding Department	= 450 × $8.33 = 3,748.50
	Finishing Department	= 100 × $3.20 = 320.00
		$5,733.50

NMO	Framing Department	= 200 × $3.33 = $666.00
	Grinding Department	= 50 × $8.33 = 416.50
	Finishing Department	= 50 × $3.20 = 160.00
		$1,242.50

c.

Rough Framing	$= \frac{\$300{,}000}{100{,}000}$	= $3.00 per hour
Fine Framing	$= \frac{\$100{,}000}{20{,}000}$	= $5.00 per hour
Rough Grinding	$= \frac{\$250{,}000}{50{,}000}$	= $5.00 per hour
Fine Grinding	$= \frac{\$250{,}000}{10{,}000}$	= $25.00 per hour
Rough Finishing	$= \frac{\$400{,}000}{200{,}000}$	= $2.00 per hour
Fine Finishing	$= \frac{\$400{,}000}{50{,}000}$	= $8.00 per hour

WCB	Fine Finishing	=	500 × $5.00	=	$ 2,500.00
	Fine Grinding	=	450 × $25.00	=	11,250.00
	Fine Finishing	=	100 × $8.00	=	800.00
					$14,550.00
NMO	Rough Framing	=	200 × $3.00	=	$ 600.00
	Rough Grinding	=	50 × $5.00	=	250.00
	Rough Grinding	=	50 × $2.00	=	100.00
					$ 950.00

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A. Activity-based costing
B. Activity cost pools
C. Activity rate
D. Engineering change order
E. Multiple production department factory overhead method
F. Single plantwide factory overhead rate method

_____ 1. A method of allocating factory overhead to products, using factory overhead rates for each department.

_____ 2. The cost of an activity per unit of activity base, determined by dividing the activity cost pool by the estimated activity base.

_____ 3. An accounting framework based on determining the cost of activities and allocating theses costs to products, using activity rates.

_____ 4. A document that initiates a change in the specification of a product or process.

_____ 5. An overhead application rate that is calculated by dividing the plantwide costs of operation by the plantwide activity base.

_____ 6. Cost accumulations that are associated with a given activity, such as machine usage, inspections, moving, and production setups.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

	True	False
1. A plantwide rate for overhead allocation is the most accurate way of allocating factory costs.	_____	_____
2. Activity-based overhead allocation is superior to departmental allocation rates for factory overhead. . . .	_____	_____
3. Activity-based allocation of factory overhead is inferior to factory wide overhead allocation.	_____	_____
4. When factory-wide overhead costs are divided by the activity base of a department, the result is the departmental overhead rate.	_____	_____
5. The projected cost of operating an activity for a year is divided by the activity base of the activity to arrive at the activity cost for overhead application.	_____	_____
6. Activity-based costing is not important to the field of costing, as it has little application to the current trends of costing.	_____	_____
7. When we refer to the cost driver for an application, we are referring to the way the application incurs costs.	_____	_____
8. Most cost accountants believe that a factory wide overhead rate is the most accurate way of applying overhead costs	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. Factory overhead is the application of the following cost(s) to production:

- **a.** Cost of rent for the factory
- **b.** Cost of amortization for the factory equipment
- **c.** Cost of property taxes for the factory
- **d.** All of the above
- **e.** None of the above

2. When a departmental overhead rate is calculated, the formula is:
   a. the total budgeted overhead cost of the factory divided by the total activity of the factory
   b. the total actual overhead costs of the department divided by the actual activity of the department
   c. the budgeted overhead cost of an activity divided by the actual cost of the activity
   d. the budgeted overhead cost of the department divided by the actual activity of the department
   e. none of the above
3. The calculation for the overhead application rate of an activity is:
   a. the actual cost of the activity divided by the actual activity base
   b. the budgeted cost of the department divided by the budgeted activity base of the department
   c. the budgeted cost of the activity divided by the budgeted activity base of the activity
   d. the budgeted factory overhead cost divided by the activity base of the activity
   e. none of the above
4. When required to produce accurate costing of overhead in a factory that has departments that have differing activities within the departments, the accountant will select the following method of overhead allocation:
   a. factory-wide rate
   b. departmental rate
   c. activity-based rate
   d. all of the above
   e. none of the above
5. The Milling Department incurs its costs from the use of large robotic machines that have amortization costs, repair costs, and operations costs. There are only a few highly trained technicians in the department. The best activity base to cost out overhead would be:
   a. direct labour hour basis
   b. direct labour cost basis
   c. machine hour basis
   d. none of the above
   e. all of the above

6. The Fine Finishing Department is a labour-intensive department, where different staff are paid very different hourly rates, which are based on their trades training. The best activity base to cost out overhead would be:
   a. direct labour hour basis
   b. direct labour cost basis
   c. machine hour basis
   d. none of the above
   e. all of the above

7. Activity based costing is useful in:
   a. costing production
   b. costing in the service industry
   c. all of the above
   d. none of the above

8. The least expensive way of allocating overhead is:
   a. activity-based allocation
   b. factory-wide allocation
   c. departmental allocation
   d. all of the above
   e. none of the above

EXERCISE 21–1

ZYX Company makes knives at their plant in Winnipeg, Manitoba. The budgeted cost of overhead for the factory include the following:

Equipment Amortization	$50,000
Building Amortization	24,000
Utilities	90,000
Indirect Materials	32,000
Indirect Labour	42,000

A factory-wide overhead application rate is calculated based on the budgeted activity of 100,000 hours of operation.

Instructions

1. Determine the factory-wide application rate for overhead applied to production.
2. If we manufactured the following items, what would the application of overhead be that would be assigned to each of the products?

   Chief's Knife .8 of an hour
   Butcher Knife 1.2 hours

EXERCISE 21–2

Triciacom Company manufactures software in two departments. The cost of the departments and the activity base for the departments are listed below:

Department Name	Budgeted Cost of Operation	Activity Base of the Department
Department One	$ 55,000,000	1,000,000 machine hours
Department Two	$250,000,000	5,000,000 labour hours

Instructions: Calculate the cost of overhead to be charged to each of the following production runs.

1. Viking Software—requires 500 hours of machine application in Department One and 100 hours of labour in Department Two.
2. Byte-Me Software = require 250 hours of machine application in Department One and 30 hours of labour in Department Two.

EXERCISE 21–3

Z.M.P. Company manufactures three different products for their customers. The product lines are economy, mid-range, and deluxe. The production takes place in the machining and the finishing departments. The machining department uses an application rate based on the number of machine hours worked for the budgeted year. The finishing department which is labour-oriented uses a labour hour application rate. The following data are for the budgeted production.

	Factory Overhead Budgeted	Budgeted Activity
Machining Department overhead	$276,000	16,000 machine hours
Finishing Department overhead	$480,000	48,000 labour hours

Production information for the manufacture of the product per unit is as follows:

	Economy	Mid-Range	Deluxe
Machining Department	.05 hours	.10 hours	.15 hours
Finishing Department	.08 hours	.18 hours	.25 hours

Instructions

1. Calculate the overhead rates for the departments.
2. Calculate the overhead that would be applied to each of the products.

EXERCISE 21-4

L.M.N. Company manufactures moldings. The activities in the manufacture are:

Casting	$360,000	Machine Hours
Assembly	300,000	Direct Labour Hours
Inspection	33,000	Inspections
Set-Up	100,000	Number of Set-Ups
Materials handling	60,000	Number of Loads

Corporate records were obtained to estimate the amount of activity to be used by two products. The estimated activity-base usage quantities and units produced are proved in the following table:

Activity Base	Product One	Product Two	Total
Machine Hours	40,000	50,000	90,000
Direct Labour Hours	35,000	25,000	60,000
Number of Inspections	10,000	10,000	20,000
Number of Set-Ups	15,000	25,000	40,000
Number of Loads	20,000	20,000	40,000
Units Produced			
Number of Units	10,000	10,000	20,000

Instructions

1. Calculate the activity-based overhead application for each of the activities.
2. Calculate the overhead to be applied to each of the products.

PROBLEM 21–1

A.A.B. Corporation manufactures wooden tables for use in schools and community clubs. There are five activities that take place in the manufacture of these products.

Activity	Activity Cost Pool	Activity Base
Assembly	$455,000	Units Constructed
Sanding	560,000	Machine Hours of Sanding
Painting	370,000	Labour Hours of Painting
Application of Design Work	3,230,000	Labour Hours of Design
Inspection of Finished Product	280,000	Units Inspected

Corporate records were obtained to estimate the amount of activity to be used by the two products. The estimated activity-base usage quantities and units produced are listed below.

Activity Base	School Table	Community Club Table	Total
Units Constructed	40,000	100,000	140,000
Machine House of Sanding	120,000	200,000	320,000
Labour Hours of Painting	50,000	150,000	200,000
Labour House of Design	80,000	300,000	380,000
Inspection of Product	40,000	100,000	140,000

Instructions

1. Calculate the activity rate for each of the activity centres.
2. Use the activity rates you have calculated to calculate the cost of overhead to be applied to each of the production runs.

PROBLEM 21–2

J.G. Bresch Corporation manufactures widgets and gidgets. The production takes place in the assembly and finishing department. The cost of factory overhead are the following:

Overhead Cost	Amount
Utilities	$500,000
Factory Building Amortization	1,800,000
Tooling Department	300,000
Equipment Amortization—Assembly	600,000
Equipment Amortization—Finishing	1,800,000

The two products consume both machine hours in the assembly department and labour hours in the finishing department. The following data was collected concerning the products' manufacture.

	Direct Labour Hours	Machine Hours
Assembly Department		
Widgets	4,000	800
Gidgets	2,000	600
Finishing Department		
Widgets	450	4,000
Gidgets	150	3,000
Total	6,600	8,400

Instructions

1. Determine the single factory overhead rate, using each of the following activity bases: (a) direct labour hours and (b) machine hours.
2. Determine the product factory overhead costs, using (a) the direct labour hour plant-wide rate and (b) the machine hour plantwide factory overhead rate.

PROBLEM 21–3

L.M.O. Corporation manufactures three plastic products. The product lines are plastic knives, plastic forks, and plastic spoons. The company budgeted the following factory overhead for the upcoming year:

Overhead Cost	Amount
Plant Building Amortization	$ 189,725
Equipment Amortization	750,000
Maintenance	480,000
Utilities	325,000
Production support	750,000
Engineering support	500,000
Total	$2,994,725

The Controller has been asking the accounting department to apply a plant-wide application rate. He has recently been reading an article that states that a better way to allocate overhead is on an activity base. The data concerning the company's operations are as follows:

Activity	Activity Cost Pool	Cost
Design	Labour Hours to Design	$670,000
Set-up	Number of Set-ups	50,000
Production	Machine Hours	2,255,500
Inspection	Labour Hours	6,625
Transport	Number of Loads Shipped	12,600
		$2,994,725

The activity-base usage quantities and units produced are as follows:

	Design Hours	# of Set-up Hours	Machine Hours	Labour Hours	Loads Shipped	Units in Cases
Plastic Knives	3,050	300	100,000	1,500	60	300,000
Plastic Forks	5,450	450	115,000	2,000	100	450,000
Plastic Spoons	4,900	500	132,000	1,800	120	960,000
	13,400	1,250	347,000	5,300	280	1,710,000

Instructions

1. Determine the activity rate for each of the activities
2. Determine the total overhead to be costed to each of the three products.
3. Determine the cost per unit for each of the products for overhead.

22 Budgeting

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 22.

1. Many new terms are introduced in this chapter. You can expect true/false, multiple-choice, or matching questions testing your knowledge of these terms. Study the Key Terms to prepare for such questions.
2. A major emphasis of this chapter is budgeting for manufacturing operations. You should be familiar with all the budgets illustrated in the chapter. The order in which the budgets are normally prepared is the same as that presented in the chapter. For example, the sales budget is normally presented first, followed by the production budget, etc. You may be required to prepare one of these budgets on a test.
3. You can also expect to see some multiple-choice questions that require the computation of the amount of materials to be purchased, units to be produced, cash receipts for a month, etc., as part of the budgeting process.

CHAPTER OUTLINE

I. Nature and Objectives of Budgeting.

A. A budget is an outline of a business's future plans, stated in financial terms.

B. Budgets are important not only for profit-making businesses, but also for nonprofit institutions ranging from rural school districts to large agencies of the federal government.

C. Budgeting involves (1) establishing specific goals for future operations, (2) executing plans to achieve the goals, and (3) periodically comparing actual results with the goals. These goals help in the planning, directing, and control functions of management.

D. Budgeting supports the planning process by requiring all organizational units to establish their goals for the upcoming period. During the planning phase of the budget process, all viewpoints are considered, options identified, and cost reduction opportunities calculated. This leads to better decision making for the organization.

E. Once the budget plans are in place, they can be used to direct and coordinate operations during the period in order to achieve the stated goals. The budgetary

units of an organization are called responsibility centres. If there is a change in the external environment, the budget process can be used to readjust the operations.

F. Once a period of time has passed, the actual performance of the operation can be compared against the planned goals. This provides employees with prompt feedback about their performance relative to the goals. This allows employees, if necessary, to adjust their activities in the future.

G. Human behaviour problems can arise if (1) the budget goal is unachievable (too tight), (2) the budget goal is very easy to achieve (too loose), or (3) the budget goals established for the business conflict with the objectives of employees (goal conflict).

H. It is important that employees (managers and non-managers) be involved in establishing budget estimates.

II. Budgeting Systems.

A. The budgeting period for operating activities normally includes the fiscal year of a business.

B. Annual budgets may be subdivided into shorter time periods, such as quarters, months, or weeks.

C. Continuous budgeting provides for the maintenance of a twelve-month projection into the future.

D. The development of a budget for the next fiscal year is usually coordinated by a budget committee made up of high-level executives such as the controller, treasurer, production manager, and sales manager.

E. The method of developing budget estimates differs among businesses.

1. One method, called zero-based budgeting, requires all levels of management to start from zero and estimate sales, production, etc., as though operations were being started for the first time.

2. Another method of developing estimates is for management to revise last year's budget amounts in light of last year's actual results and expected changes for the coming year.

F. Static budgets show the expected results for one activity level without an ability to adjust to changes in underlying activity levels. Static budgets are used in administrative units, such as purchasing, engineering, and information services.

G. Flexible budgets show the expected results for several activity levels. In constructing a flexible budget, the preparers must:

(1) identify the relevant activity levels to be budgeted,

(2) identify the fixed and variable cost components of the costs being budgeted,

(3) prepare the budget for each activity level by multiplying the variable cost per unit by the activity level and then adding the monthly fixed cost.

H. Many firms use computerized budgeting systems, which can speed up the budgeting process as well as reduce the cost of budget preparation.

III. Master Budget.

A. Manufacturing operations require a series of budgets that are linked together in a master budget. These budgets are then used to prepare the budgeted income statement and budgeted balance sheet.

B. Exhibit 6 of the chapter shows the relationship among the income statement budgets.

IV. Income Statement Budgets.

A. The sales budget normally indicates for each product (1) the quantity of estimated sales and (2) the expected unit selling price.

1. The quantity of sales can be estimated from past sales revised for factors expected to affect future sales.

2. Once the estimate of sales volume is obtained, the expected sales revenue is determined by multiplying the volume by the expected unit sales price.

B. The production needs must be carefully coordinated with the sales budget to ensure that production and sales are kept in balance during the period.

1. The number of units to be manufactured to meet budgeted sales and inventory needs for each product is set forth in the production budget.

2. The budgeted volume of production is based on the sum of (a) the expected units of sales and (b) the desired units in ending inventory, less (c) the estimated units in beginning inventory.

C. The quantities of direct materials purchases necessary to meet production needs is based on the sum of (a) the materials needed for production and (b) the desired ending materials inventory, less (c) the estimated beginning materials inventory.

1. The quantities of direct materials required are multiplied by the expected unit purchase price to determine the total cost of direct materials purchases.

2. The timing of the direct materials purchases requires close coordination between the purchasing and production departments so that inventory levels can be maintained within reasonable limits.

D. The production budget provides the starting point for the preparation of the direct labour cost budget.

1. The direct labour hours necessary to meet the production needs are multiplied by the estimated hourly rate to yield the total direct labour cost.

2. Direct labour requirements must be carefully coordinated with the production and personnel departments to ensure that enough labour will be available to meet production needs.

E. The estimated factory overhead costs necessary to meet production needs make up the factory overhead cost budget.

1. The factory overhead cost budget usually includes the total estimated cost for each item of factory overhead.

2. Supplemental schedules are often prepared to present the factory overhead cost, broken down by fixed and variable cost elements, for each individual department.

F. The budget for the cost of goods sold is prepared by combining data on the estimated inventories for finished goods and work in process with the relevant estimates of quantities and costs in the budgets for (a) direct materials purchases, (b) direct labour costs, and (c) factory overhead costs.

G. The operating expenses budget is made up of the estimated selling and administrative expenses. Detailed supporting schedules for each department are often prepared for major items in the operating expenses budget.

H. A budgeted income statement can usually be prepared from the estimated data presented in the budgets for sales, cost of goods sold, and operating expenses, combined with data on other income, other expense, and income tax. The budgeted income statement brings together in condensed form the projection of all profit-making phases of operations and enables management to assess the effects of the individual budgets on profits for the year.

V. Cash Balance Sheet

A. The cash budget presents the expected receipts (inflow) and payments (outflow) of cash for a period.

1. Estimated cash receipts are planned additions to cash from sales and other sources. Supplemental schedules, such as a schedule of cash receipts from collections of receivables, can be helpful.
2. Estimated cash payments are planned reductions in cash from manufacturing costs, operating expenses, capital expenditures, and other sources. As with cash receipts, supporting schedules can be used.

B. The estimated cash balance at the end of the period can be compared to the minimum balance required by operations. The difference is the anticipated excess or deficiency for the period. Minimum cash balances are maintained to serve as a safety buffer for variations in estimates and for unexpected emergencies.

C. The capital expenditures budget summarizes future plans for acquiring plant assets.

1. The useful life of many plant assets extends over relatively long periods of time, and the amount of the expenditures for such assets may change a great deal from year to year.
2. It is normal practice to project plans for capital expenditures over a number of years.
3. The effect of the capital expenditures budget on the operating expenses budgets should also be considered. For example, depreciation on new equipment will affect the factory overhead budget.

D. The budgeted balance sheet estimates the financial condition at the end of a budget period, assuming that all operating budgets and financing plans are met.

ILLUSTRATIVE PROBLEM

Selected information concerning sales and production for Baird Inc. for June of the current year is as follows:

a. Estimated sales:

Product X: 120,000 units at $40 per unit

Product Y: 20,000 units at $15 per unit

b. Estimated inventories at June 1:

Direct materials:

Material A: 14,300 lbs.
Material B: 18,600 lbs.

Work in process: $28,500

Finished products:

Product X: 16,000 units at $28 per unit
Product Y: 3,000 units at $11 per unit

c. Desired inventories at June 30:

Direct materials:

Material A: 20,000 lbs.
Material B: 9,000 lbs.

Work in process: $29,000

Finished products:

Product X: 11,000 units at $28 per unit
Product Y: 1,500 units at $11 per unit

d. Direct materials used in production:

In manufacture of Product X:

Material A: 1.3 lbs. per unit of product
Material B: .7 lbs. per unit of product

In manufacture of Product Y:

Material B: .8 lbs. per unit of product

e. Anticipated cost of purchases and beginning and ending inventory of direct materials:

Material A: $7 per lb.
Material B: $4 per lb.

f. Direct labour requirements:

Product X:

Department 100: .8 hour at $15 per hour
Department 200: .1 hour at $12 per hour

Product Y:

Department 200: .2 hour at $12 per hour
Department 300: .5 hour at $11 per hour

g. Estimated factory overhead costs for June:

Indirect factory wages	125,000
Amortization of plant and equipment	120,000
Supervisory salaries	100,000
Power and light	80,000
Indirect materials	40,000
Maintenance	25,000
Insurance and property taxes	20,000
Total	$510,000

Instructions

1. Prepare a sales budget for June.
2. Prepare a production budget for June.
3. Prepare a direct materials budget for June.
4. Prepare a direct labour cost budget for June.
5. Prepare a cost of goods sold budget for June.

Solution

1.

BAIRD INC.
Sales Budget
For Month Ending June 30, 20—

	Unit Sales Volume	Unit Selling Price	Total Sales
Product X	120,000	$40	$4,800,000
Product Y	20,000	15	300,000
Total revenue from sales			$5,100,000

2.

BAIRD INC.
Production Budget
For Month Ending June 30, 20—

	Units	
	Product X	Product Y
Sales	120,000	20,000
Plus desired inventory, June 30, 20—	11,000	1,500
Total	131,000	21,500
Less estimated inventory, June 1, 20—	16,000	3,000
Total production	115,000	18,500

3.

BAIRD INC.
Direct Materials Purchases Budget
For Month Ending June 30, 20—

	Direct Materials		
	A	B	Total
Pounds required for production:			
Product X (115,000 × lbs. per unit)	149,500 (a)	80,500 (b)	
Product Y (18,500 × lbs. per unit)	—	14,800 (c)	
Plus desired inventory, June 30, 20—	20,000	9,000	
Total	169,500	104,300	
Less estimated inventory, June 1, 20—	14,300	18,600	
Total units to be purchased	155,200	85,700	
Unit price	$7	$4	
Total direct materials purchases	$1,086,400	$342,800	$1,429,200

Calculations:

(a) 115,000 × 1.3 = 149,500

(b) 115,000 × 7 = 80,500

(c) 18,500 × 8 = 14,800

4.

BAIRD INC.
Direct Labour Cost Budget
For Month Ending June 30, 20—

	Dept. 100	Dept. 200	Dept. 300	Total
Hours required for production:				
Product X (115,000 × hrs. per unit)	92,000 (a)	11,500 (b)	—	
Product Y (18,500 × hrs. per unit)	—	3,700 (c)	9,250 (d)	
Total	92,000	15,200	9,250	
Hourly rate	$15	$12	$11	
Total direct labour cost	$1,380,000	$182,400	$101,750	$1,664,150

Calculations:

(a) 115,000 × 8 = 92,000

(b) 115,000 × .1 = 11,500

(c) 18,500 × 2 = 3,700

(b) 18,500 × .5 = 9,250

5.

BAIRD INC.
Cost of Goods Sold Budget
For Month Ending June 30, 20—

Finished goods inventory, June 1, 20—			$ 481,000 (a)
Work in process inventory, June 1, 20—		$28,500	
Direct materials:			
Direct materials inventory, June 1, 20—	$ 174,500 (b)		
Direct materials purchases	1,429,200 (c)		
Cost of direct materials available for use	$ 1,603,700		
Less direct materials inventory, June 30, 20—	176,000 (d)		
Cost of direct materials placed in production	$ 1,427,700		
Direct labour	1,664,150 (e)		
Factory overhead	510,000		
Total manufacturing costs		3,601,850	
Total work in process during period		$3,630,350	
Less work in process inventory, June 30, 20—		29,000	
Cost of goods manufactured			3,601,350
Cost of finished goods inventory, June 30, 20—			$4,082,350
Less finished goods inventory, June 30, 20—			324,500 (f)
Cost of goods sold			$3,757,850

Calculations:

(a)	Product X (16,000 × $28)	$ 448,000	(d)	Material A (20,000 × $7)	$ 140,000
	Product Y (3,000 × $11)	33,000		Material B (9,000 × $4)	36,000
	Total	$ 481,000		Total	$ 176,000
(b)	Material A (14,300 × $7)	$ 100,100	(e)	Department 100	$1,380,000
	Material B (18,600 × $4)	74,400		Department 200	182,400
	Total	$ 174,500		Department 300	101,750
				Total	$1,664,150
(c)	Material A	$1,086,400	(f)	Product X (11,000 × $28)	$ 308,000
	Material B	342,800		Product Y (1,500 × $11)	16,500
	Total	$1,429,200		Total	$ 324,500

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A.	Balance sheet budget	H.	Flexible budget
B.	Budget	I.	Master budget
C.	Budgeted production	J.	Production budget
D.	Capital expenditures budget	K.	Responsibility centre
E.	Cash budget	L.	Sales budget
F.	Continuous budgeting	M.	Static budget
G.	Income statement budget	N.	Zero-based budgeting

_____ 1. An outline of a business's future plans, expressed in financial terms.

_____ 2. A concept of budgeting which requires all levels of management to start from zero and estimate sales, production, and other operating data as though operations were being started for the first time.

_____ 3. A method of fiscal-year budgeting which provides for maintenance of a twelve-month projection into the future.

_____ 4. The coordinated budget for a business.

_____ 5. The first budget usually prepared.

_____ 6. A budget which contains budgeted amounts for varying levels of activity.

_____ 7. The sum of (a) the expected sales volume and (b) the desired ending inventory, less (c) the inventory expected to be available at the beginning of the year.

_____ 8. A budget that does not adjust to changes in activity levels.

_____ 9. A budget summarizing future plans for acquiring plant facilities and equipment.

_____ 10. An organizational unit for which a manager is assigned responsibility for the unit's performance.

_____ 11. A budget which presents the expected receipts (inflows) and payments (outflows) for a given period.

_____ 12. A budget made up of the sales budget, production budget, direct materials purchases budget, direct labour cost budget, factory overhead cost budget, cost of goods sold budget, and the operating expenses budget.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

	True	False
1. A zero-based budget is actually a series of budgets for varying rates of activity.	_____	_____

	True	False
2. A budgeting method which provides for maintenance of a twelve-month projection into the future is called continuous budgeting.	_____	_____
3. Computers are seldom used in the budget process, although computers can reduce the cost of budget preparation.	_____	
4. The number of units of each commodity expected to be manufactured to meet budgeted sales and inventory requirements is set forth in the production budget. . . .	_____	
5. An accounts receivable collection schedule is useful for developing a cash budget.	_____	_____
6. The amount of the expenditures for capital assets such as machinery and equipment usually remains fairly constant from year to year.	_____	_____
7. Minimum cash balances are maintained to serve as a safety buffer for variations in estimates and for unexpected emergencies.	_____	_____
8. The budgeted balance sheet brings together the projection of all profit-making phases of operations. . .	_____	_____
9. Estimated cash receipts in the cash budget are also known as outflow.	_____	_____
10. The sales budget normally indicates for each product the quantity of estimated sales and the expected unit selling price.	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. Which of the following budgets provides the starting point for the preparation of the direct materials purchases budget?
   - **a.** direct labour cost budget
   - **b.** cash budget
   - **c.** production budget
   - **d.** cost of goods sold budget

2. The budget which provides data on the quantities of direct materials purchases necessary to meet production needs is the:
   a. direct materials purchases budget
   b. sales budget
   c. production budget
   d. direct labour cost budget

3. This budget summarizes future plans for the acquisition of plant facilities and equipment.
   a. budgeted balance sheet
   b. production budget
   c. cash budget
   d. capital expenditures budget

4. A series of budgeted amounts for varying levels of activity is called a:
   a. variable budget
   b. continuous budget
   c. flexible budget
   d. zero-based budget

5. Which of the following budgets is used most frequently in general and administrative cost centres?
   a. incremental budget
   b. zero-based budget
   c. static budget
   d. flexible budget

6. Assume 80% of sales are collected in the month of sale, with the remainder the following month. Sales for October and November were $640,000 and $860,000, respectively. What are the cash receipts from accounts receivable collections for November?
   a. $684,000
   b. $816,000
   c. $812,000
   d. $860,000

EXERCISE 22–1

Texier Inc. manufactures two products, C and Q. It is estimated that the May 1 inventory will consist of 8,000 units of C and 21,000 units of Q. Estimated sales for May by sales territory are as follows:

East: Product C—60,000 units at $15 per unit
Product Q—75,000 units at $8 per unit

West: Product C—80,000 units at $20 per unit
Product Q—50,000 units at $10 per unit

An ending inventory of 20% of May sales is desired.

Instructions: Complete the following sales and production budgets for the month of May.

Texier Inc.

Sales Budget

For the Month of May, 20—

PRODUCT AND AREA	UNIT SALES VOLUME	UNIT SELLING PRICE	TOTAL SALES
Product C:			
East area			
West area			
Total			
Product Q:			
East area			
West area			
Total			
Total revenue from sales			

Texier Inc.

Product Budget

For the Month of May, 20—

	UNITS	
	PRODUCT C	PRODUCT Q
Sales		
Plus desired inventory, May 31		
Total		
Less estimated inventory, May 1		
Total production		

EXERCISE 22–2

Instructions: Complete the following factory overhead cost budget for Nathalie Inc. for the month of January. The items listed as variable costs are assumed to vary directly with the units of product. The items listed as fixed costs are assumed to remain constant regardless of units produced.

Nathalie Inc.

Factory Overhead Cost Budget

For the Month of January, 20—

Units of product	30,000	60,000	90,000
Variable cost:			
Indirect factory wages ($.80 per unit)	$ 24000		
Indirect materials ($.45 per unit)	13500		
Electric power ($.60 per unit)	18000		
Total variable cost	$ 55500		
Fixed cost:			
Supervisory sales	$ 30000		
Amortization of plant and equipment	18000		
Property taxes	12000		
Insurance	7500		
Electric power	4500		
Total fixed cost	$ 72000		
Total factory overhead cost	$ 127500		

PROBLEM 22–1

The treasurer of Amant Inc. has accumulated the following budget information for the next two months:

	March	April
Sales	$240,000	$200,000
Merchandise costs	150,000	120,000
Operating expenses	60,000	40,000
Capital expenditures	———	125,000

The company expects to sell about 40% of its merchandise for cash. Of sales on account, 80% are expected to be collected in full in the month of the sale and the remainder in the month following the sale. One-third of the merchandise costs are expected to be paid in the month in which they are incurred and the other two-thirds in the following month. Amortization, insurance, and property taxes represent $20,000 of the probable monthly operating expenses. Insurance is paid in December and a $5,000 installment on property taxes is expected to be paid in March. Of the remainder of the operating expenses, 60% are expected to be paid in the month in which they are incurred and the balance in the following month. Capital expenditures of $125,000 are expected to be paid in April.

Current assets as of March 1 are composed of cash of $24,000 and accounts receivable of $45,000. Current liabilities as of March 1 are composed of accounts payable of $90,000 ($80,000 for merchandise purchases and $10,000 for operating expenses). Management desires to maintain a minimum cash balance of $50,000 at the end of March and April.

Instructions: Prepare a monthly cash budget for March and April.

Amant, Inc.

Cash Budget

For Two Months Ending April 30, 20—

	MARCH	APRIL

PROBLEM 22–2

The Fernandez Furniture Company produces two products, Product A and Product B. The management wishes to budget the sales, production, direct material, and direct labour for the upcoming year. In order to meet this request you have obtained information from various managers throughout the organization. The sales budget was provided by the Sales Department as follows:

Product	Unit Sales Volume	Unit Sales Price	Total Sales
Product A	168,000	$4.20	$ 705,600
Product B	324,000	$8.80	2,851,200
Total			$3,556,800

Information about the inventories for Product A and Product B was obtained by the production manager:

	Product A	Product B
Estimated units in beginning inventory	12,000	24,000
Desired units in ending inventory	8,000	36,000

The materials manager provided information about the materials used in production. There are three different materials used to manufacture Fernandez products: Material X, Material Y, and Material Z. The standard number of pounds required for each unit of Product A and B were determined from the bill of materials:

Standard material pounds per unit	Product A	Product B
Material X	0.6 pounds	1.8 pounds
Material Y		3.4 pounds
Material Z	1.2 pounds	

The purchasing manager provided the standard price per pound for each of the materials:

Material	Price per Pound
Material X	$0.40
Material Y	$0.50
Material Z	$0.60

The materials manager was responsible for the materials inventories and provided the following inventory information:

	Product		
	Material X	Material Y	Material Z
Estimated units in beginning inventory	16,000	5,600	12,400
Desired units in ending inventory	14,500	8,700	9,800

Products A and B are manufactured in two departments, 1 and 2. The industrial engineers provided standard direct labour information from the routing files.

Standard hours per unit	Dept. 1	Dept. 2
Product A	0.20 hours	0.15 hours
Product B	0.05 hours	0.10 hours

The labour rates in each department were provided by the department supervisor for each department.

	Dept. 1	Dept. 2
Labour cost per hour	$14.00	$18.00

Instructions: Construct the following budgets for Fernandez Furniture Company:

(1) Production budget
(2) Direct materials purchases budget
(3) Direct labour cost budget

Fernandez Furniture Company

Production Budget

	PRODUCT A	PRODUCT B

Fernandez Furniture Company

Direct Materials Purchases Budget

	MATERIAL X	MATERIAL Y	MATERIAL Z	TOTAL

Fernandez Furniture Company

Direct Labour Cost Budget

	DEPT. 1	DEPT. 2	TOTAL

23 Performance Evaluation Using Variances from Standard Costs

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 23.

1. Many new terms are introduced in this chapter. You can expect true/false, multiple-choice, or matching questions testing your knowledge of these terms. Study the Key Terms to prepare for such questions.
2. The major emphasis of this chapter is standard costing. You should be able to compute the six variances illustrated in the chapter. The Illustrative Problem in the Chapter Review is a good study aid for the computation of variances.
3. You also should be able to perform variance analysis based on a flexible budget.
4. Depending upon whether your instructor emphasized standards in the accounts in lecture or through homework, you may be required to prepare journal entries for incorporating standards in the accounts. If your instructor did not cover this topic in class, then do not spend much time studying this section of the chapter.

CHAPTER OUTLINE

I. Standards.

- **A.** Standards are performance benchmarks used to evaluate and control operations.
- **B.** Accounting systems that use standards for each element of manufacturing cost entering into the finished product are called standard cost systems.
  1. Such systems determine how much a product should cost (standard cost), how much it does cost (actual cost), and the causes of any difference (variance from standard) between the two.
  2. Standard costs thus serve as a device for controlling costs and measuring efficiency.
- **C.** The setting of standards normally requires the joint efforts of accountants, engineers, and other management personnel. The managerial accountant plays an essential role by expressing the results of judgments and studies in dollars and cents.

D. Standards that represent levels of performance achieved only under perfect operating conditions are called theoretical standards or ideal standards. Such standards are not widely used.

E. Currently attainable standards (sometimes called normal standards) represent levels of operation that can be attained with reasonable effort.

F. Standards should be continuously reviewed; when they no longer reflect operating conditions, they should be revised.

G. The use of standards has received some criticism for restricting continuous improvement of operations. Regardless of this criticism, standards are widely used.

II. Flexible Budgeting and Control.

A. The control function known as budgetary performance evaluation compares the actual performance against the budget.

B. Gamon Gomes Ltd. uses flexible budgeting in preparing its master budget. This means budgeted materials purchases, direct labour, and factory overhead are determined by multiplying the standard cost by different estimates of production. The actual production costs for the period should be compared to the flexible budget at actual volumes of production.

C. The difference between the actual cost and the flexible budget at the actual volume is called a cost variance. A favourable cost variance occurs when actual cost is less than budgeted cost. An unfavourable variance occurs when actual cost exceeds budgeted cost.

D. A budget performance report compares actual results with the budgeted amounts for the level of production achieved. A budget performance report for Gamon Gomes Ltd. is shown in Exhibit 2 of the chapter.

III. Direct Materials Variances.

A. The direct materials cost variances can be separated into two variances, the price variance and the quantity variance.

B. The direct materials price variance is the difference between the actual price per unit and the standard price per unit, multiplied by the actual quantity used.

$$\text{Direct Materials Price Variance} = \left(\text{Actual Price per Unit} - \text{Standard Price} \right) \times \text{Actual Quantity Used}$$

C. The direct materials quantity variance is the difference between the actual quantity used and the standard quantity at actual production, multiplied by the standard price per unit.

$$\text{Direct Materials Quantity Variance} = \left(\text{Actual Quantity Used} - \text{Standard Quantity}\right) \times \text{Standard Price per Unit}$$

D. The direct materials variances can be illustrated by making three calculations as shown in Exhibit 3 of the chapter. These calculations include:

1. Determine the actual cost: actual quantity x actual price
2. Determine the actual quantity at the standard price: actual quantity x standard price
3. Determine the standard materials budgeted at actual production: standard quantity x standard price

The difference between the first and second calculations is the price variance, while the difference between the second and third calculations is the quantity variance. The difference between the first and third calculations is the total cost variance.

E. The direct materials quantity variance should be reported to the proper operating management level. The direct materials price variance should normally be reported to the Purchasing Department.

IV. Direct Labour Variances.

A. The direct labour cost variance can be subdivided into two variances, the rate variance and the time variance.

1. The direct labour rate variance is computed as follows:

$$\text{Direct Labour Rate Variance} = \left(\text{Actual Rate per Hour} - \text{Standard Rate}\right) \times \text{Actual Hours Worked}$$

2. The direct labour time variance is computed as follows:

$$\text{Direct Labour Time Variance} = \left(\text{Actual Hours Worked} - \text{Standard Hours}\right) \times \text{Standard Rate per Hour}$$

B. The direct labour variances can be illustrated by making three calculations as shown in Exhibit 4 of the chapter. These calculations are:

1. Determine the actual cost: actual hours x actual rate
2. Determine the actual hours at the standard rate: actual hours x standard rate
3. Determine the standard direct labour cost at actual production: standard hours x standard rate.

The difference between the first and second calculations is the rate variance, while the difference between the second and third calculations is the time variance. The difference between the first and third calculations is the total cost variance.

C. Controlling direct labour cost is often the responsibility of the production supervisors. Comparing standard direct labour hours and actual direct labour hours provides the basis for investigating any major time variances. Comparing the rates paid for direct labour with the standard rates provides a basis for investigating any major rate variances.

V. Factory Overhead Variances.

A. Factory overhead costs are more difficult to manage than are direct labour and materials costs because the relationship between production volume and indirect costs is not as easy to determine. One way to respond to this difficulty is by separating factory overhead into variable and fixed costs.

B. A flexible budget may be used to determine the impact of production volume changes on fixed and variable factory overhead. The standard overhead rate is determined by dividing the budgeted factory overhead costs by the standard amount of productive activity, such as direct labour hours.

C. Variances from standard for factory overhead cost result from:

1. Incurring a total amount of variable factory overhead cost greater or less than the amount of variable factory overhead budgeted for actual production.
2. Operating at a level above or below 100% of normal capacity. The first factor results in a controllable variance with respect to variable overhead costs. The second factor results in a volume variance with respect to fixed overhead costs.

D. The variable factory overhead controllable variance is the difference between the actual amount of variable overhead incurred and the amount of budgeted variable overhead for actual hours worked. The controllable variance measures the efficiency of using variable overhead resources. It is computed as follows:

$$\text{Factory Overhead Controllable Variance} = \text{Actual Variable Factory Overhead} - \text{Budgeted Variable Factory Overhead for Actual Amount Produced}$$

E. The fixed factory overhead volume variance is the difference between the budgeted fixed overhead at 100% of normal capacity and the standard fixed overhead for the actual production achieved during the period. It can be computed as follows:

$$\text{Factory Overhead Volume Variance} = \left(\text{Hours at 100\% of normal capacity} - \text{Standard Hours for Actual Production}\right) \times \text{Standard Fixed Overhead Rate}$$

F. The total factory overhead cost variance is the difference between the actual factory overhead and the total overhead applied to production, using the predetermined factory overhead rate.

G. Each cost element of both the variable factory overhead and fixed factory overhead is often summarized in a factory overhead cost variance report.

VI. Recording and Reporting Variances from Standards.

A. One approach to recording standards in the accounts is to record the standard costs and variances at the same time the actual manufacturing costs are recorded in the accounts.

B. The materials account is debited for the standard costs of the materials purchased. Any direct materials price variance is recorded at that time.

C. The work in process account is debited for the standard costs of direct materials, direct labour, and factory overhead and any related variances are recorded.

D. The work in process account is credited for the standard cost of the product completed and transferred to the finished goods account.

E. Variances from standard costs are usually not reported to shareholders and others outside of management. However, the variances are often reported in income statements prepared for use by management.

F. At the end of the fiscal year, the variances from standard are usually transferred to the cost of goods sold account. However, if the variances are significant or if many of the products manufactured are still on hand, the variances should be allocated to the work in process, finished goods, and cost of goods sold accounts. The result of such an allocation is to convert these account balances from standard cost to actual cost.

VII. Standards for Nonmanufacturing Expenses.

A. When nonmanufacturing activities are repetitive and generate a common output, the concept of standards can be applied. In these cases, the process of estimating and using standards is similar to that described for a manufactured product.

B. In practice, using standards for nonmanufacturing expenses is becoming more common. When standards are not used, such expenses are normally controlled by using static budgets.

VIII. Nonfinancial Performance Measures.

A. Many managers believe that financial performance measures should be supplemented with nonfinancial measures of performance. Measuring both financial and nonfinancial performance helps employees consider multiple, and sometimes conflicting, performance objectives.

B. Nonfinancial performance measures bring additional perspectives, such as quality of work, to evaluating performance. Examples of nonfinancial performance measures include: inventory turnover, employee satisfaction, number of customer complaints, etc.

ILLUSTRATIVE PROBLEM

Wolfram Inc. manufactures Product S for national distribution. The standard costs and actual costs for direct materials, direct labour, and factory overhead incurred for the manufacture of 1,000 units of Product S were as follows:

	Standard Costs	Actual Costs
Direct materials	1,000 lbs. at $75	980 lbs. at $75.50
Direct labour	12,500 hrs. at $9	12,600 hrs at $8.95
Factory overhead	Rates per labour hour based on 100% of productive capacity of 15,000 labour hours:	
	Variable cost $3.50	$44,150 variable cost
	Fixed cost $1.00	$15,000 fixed cost

Twelve and one-half machine hours are required per unit.

Instructions

1. Determine the price variance, quantity variance, and total direct materials cost variance for Product S.
2. Determine the rate variance, time variance, and total direct labour cost variance for Product S.
3. Determine the controllable variance, volume variance, and total factory overhead cost variance for Product S.

Solution

1.

Direct Materials Cost Variances		
Price variance:		
Actual price	$75.50 per lb.	
Standard price	75.00 per lb.	
Variance—unfav.	$ .50 per lb. × actual qty. 980	$490
Quantity variance:		
Actual quantity	980 lbs.	
Standard quantity	1,000 lbs.	
Variance—favourable	20 lbs. × standard price $75	1,500
Total direct materials cost variance—favourable		$ 1,010

2. Direct Labour Cost Variances

Rate variance:		
Actual rate	$8.95	
Standard rate	9.00	
Variance–favourable	-$ .05 per hr. × actual time, 12,600	$ 630
Time variance:		
Actual time	12,600 hrs.	
Standard time	12,500 hrs.	
Variance–unfavourable	100, hrs. x standard rate, $9	900
Total direct labour cost variance—unfavourable		$ 270

3. Factory Overhead Cost Variances

Controllable variance:		
Actual variable factory overhead cost incurred	$59,150	
Budgeted variable factory overhead for 12,500 hrs.	58,750*	
Variance—unfavourable,		$400
Volume variance:		
Budgeted hours at 100% of normal capacity	15,000 hrs.	
Standard hours for amount produced	12,500 hrs.	
Productive capacity not used	2,500 hrs.	
Standard fixed factory overhead cost rate	x $1	
Variance—unfavourable		2,500
Total factory overhead cost variance—unfavourable,		$ 2,900

*(12,500 hrs. × $3.50) + $15,000

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A. Actual cost system
B. Budget performance report
C. Controllable variance
D. Cost variance
E. Currently attainable standards
F. Direct labour rate variance
G. Direct labour time variance
H. Direct materials price variance
I. Direct materials quantity variance
J. Favourable variance
K. Standard costs
L. Standard cost system
M. Theoretical standards
N. Unfavourable variance
O. Variance from standard
P. Volume variance

_____ 1. The cost associated with the difference between the standard price and actual price of direct materials used in producing a commodity.

_____ 2. Standards that represent levels of operation that can be attained with reasonable effort.

_____ 3. The difference between actual cost and the flexible budget at actual volumes.

_____ 4. Standards that represent levels of performance that can be achieved only under perfect operating conditions.

_____ 5. The cost associated with the difference between the standard rate and the actual rate paid for direct labour used in producing a commodity.

_____ 6. The difference between the standard cost and the actual cost.

_____ 7. The difference between the budgeted fixed overhead at 100% of normal capacity and the standard fixed overhead for the actual production achieved during the period.

_____ 8. The cost associated with the difference between the standard quantity and the actual quantity of direct materials used in producing a commodity.

_____ 9. If the actual cost exceeds the standard cost, the variance is said to be a(n) (?).

_____ 10. Cost systems using detailed estimates of each element of manufacturing cost entering into the finished product.

_____ 11. The difference between the actual amount of variable factory overhead cost incurred and the amount of variable factory overhead budgeted for the period.

_____ 12. The cost associated with the difference between the standard hours and the actual hours of direct labour spent producing a commodity.

_____ 13. A report comparing actual results with budgeted figures.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

		True	False
1.	Differences between the standard costs of a department or product and the actual costs incurred are termed variances.	_____	_____
2.	If the actual unit price of the materials differs from the standard price, there is a quantity variance.	_____	_____
3.	If the actual direct labour hours spent producing a product differ from the standard hours, there is a direct labour time variance.	_____	_____
4.	The difference between the actual factory overhead and the budgeted factory overhead for the level of production achieved is called the volume variance.. . .	_____	_____
5.	Accounting systems that use standards for each element of manufacturing cost entering into the finished product are called standard cost systems. . . .	_____	_____
6.	At the end of the year, the variances from standard are usually transferred to the work in process account . . .	_____	_____
7.	A standard level of operation that can be attained with reasonable effort is called an ideal standard.	_____	_____
8.	A useful means of reporting standard factory overhead cost variance data is through a factory overhead cost variance report.	_____	_____
9.	Standards should only be applied in factory settings. .	_____	_____
10.	An example of nonfinancial performance measures is the number of customer complaints	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. Standard costs serve as a device for measuring:
   a. efficiency
   b. nonfinancial performance
   c. volume
   d. quantity

2. Woodson Inc. produced 6,000 light fixtures in May of the current year. Each unit requires 0.75 standard hours. The standard labour rate is $10.00 per hour. Actual direct labour for May was 4,800 hours. What is a direct labour time variance?
   a. $3,000 favourable
   b. $6,000 unfavourable
   c. $3,000 unfavourable
   d. $9,000 favourable

3. The following data relate to direct materials cost for May:

Standard costs (5,000 lbs. at $2 per lb.)	$10,000
Actual costs (5,100 lbs. at $3 per lb.)	15,300

   What is the direct materials quantity variance?
   a. $200 favourable
   b. $200 unfavourable
   c. $300 favourable
   d. $300 unfavourable

4. Lloyd Company produces music boxes. The standard factory overhead cost at 100% of normal capacity is $100,000 (20,000 hours at $5: $3 variable, $2 fixed). If 700 hours were unused, the fixed factory overhead volume variance would be:
   a. $700 favourable
   b. $1,400 favourable
   c. $2,100 unfavourable
   d. $1,400 unfavourable

5. The Hill Company produced 5,000 units of X. The standard time per unit is .25 hours. The actual hours used to produce 5,000 units of X was 1,350 hours. The standard labour rate is $12.00 per hour. The actual labour cost was $18,900. What is the total direct labour cost variance?
   a. $1,200 unfavourable
   b. $3,900 unfavourable
   c. $1,400 unfavourable
   d. $2,700 unfavourable

EXERCISE 23–1

The following data relate to the direct materials and direct labour costs for the production of 10,000 units of product:

Direct Materials	
Actual: 77,000 pounds at $1.82	$140,140
Standard: 75,000 pounds at $1.80	135,000
Direct Labour	
Actual: 42,500 hours at $19.75	$839,375
Standard: 42,000 hours at $20.00	840,000

Instructions

(1) Compute the price variance, quantity variance, and total direct materials cost variance.

Price variance:

Quantity variance:

Total direct materials cost variance $ _____

(2) Compute the rate variance, time variance, and total direct labour cost variance.

Rate variance:

Time variance:

Total direct labour cost variance $ _____

EXERCISE 23-2

The following data relate to factory overhead cost for the production of 20,000 units of product:

Actual:	Variable factory overhead	$153,500
	Fixed factory overhead	120,000
Standard	30,000 hours at $8	240,000

Productive capacity of 100% was 40,000 hours and the factory overhead cost budgeted at the level of 30,000 standard hours was $270,000.

Instruction: Compute the fixed factory overhead volume variance, variable factory overhead controllable variance, and total factory overhead cost variance. The fixed factory overhead rate was $3 per hour.

Controllable variance:

Volume variance:

Total factory overhead cost variance	$

EXERCISE 23-3

During January, Nathalie Inc. manufactured 60,000 units, and the factory overhead costs were: indirect factory wages, $50,500; electric power, $39,500 (included both variable and fixed components); indirect materials, $27,600; supervisory salaries, $30,000; amortization of capital equipment, $18,000; property taxes, $12,000; and insurance, $7,500.

Instructions: Prepare a budget performance report for factory overhead for January based on the above data and the factory overhead cost budget shown below.

Nathalie Inc.

Budget Performance—Factory Overhead Cost

For Month Ended January 31, 20—

	BUDGET	ACTUAL	UNFAVOURABLE	FAVOURABLE
Variable cost:				
Indirect factory wages	48000			
Indirect materials	27000			
Electric power	36000			
Total variable cost	111000			
Fixed cost:				
Supervisory salaries	30000			
Amortization of plant and equip.	18000			
Property taxes	12000			
Insurance	7500			
Electric power	4500			
Total fixed cost	72000			
Total factory overhead cost	183000			

EXERCISE 23–4

Each year, a regional Revenue Canada office processes thousands of individual tax returns. The standard for processing returns was broken into two types as follows:

Type of Return	Standard Time to Complete Processing
Traditional paper return	45 min.
Return filed electronically	8 min.

By filing their tax returns electronically, individuals reduce the amount of processing time required by the Revenue Canada employees.

The regional office employs 30 full time people (40 hrs./wk.) at $16.00 per hour. For the most recent week, the office processed 1,300 traditional returns and 225 electronically filed returns.

Instructions

(1) Compute the amount spent on labour for the week.

(2) Determine the flexible budget in hours for the actual volume for the week.

(3) Compute the time variance.

PROBLEM 23–1

Haley Inc. has established the following standard unit costs:

Materials: 10 lbs. @ $6 per lb.	$ 60.00
Labour: 3 hrs. @ $15 per hr.	45.00
Factory overhead: 3 hrs. @ $3.50 per hr.	10.50
Total standard cost per unit	$ 115.50

The factory overhead budget includes the following data:

Percent of capacity	85%	100%
Direct labour hours	76,500	90,000
Variable costs	$153,000	$ 180,000
Fixed costs	135,000	135,000
Total factory overhead cost	$288,000	$ 315,000
Variable overhead rate per hour		$ 2.00
Fixed overhead rate per hour		1.50
Total overhead rate per hour		$ 3.50

Actual manufacturing costs incurred:

Materials: 250,000 lbs. @ $6.20	$1,550,000
Labour 77,400 hrs. @ $14.60	1,130,040
Factory overhead	295,000
Total actual cost for 25,500 units	$2,975,040
Standard cost of 25,500 units (standard time, 76,500 hrs.)	2,945,250
Overall variance to be analyzed (unfavourable)	$29,790 U

Instructions

(1) Determine the price variance and quantity variance for the direct materials cost. Beside the amount of each variance, write the letter F or U to indicate whether the variance is favourable or unfavourable.

Direct Materials Cost Variances

			Variance
Price variance			
Actual price	$_____	per lb.	
Standard price	_____	per lb.	
Variance	$_____	per lb × actual qty., _____	$_____
Quantity variance:			
Actual quantity	_____	lbs.	
Standard quantity	_____	lbs.	
Variance	_____	lb. x standard price, $_____	_____
Total direct materials cost variance			$_____

(2) Determine the rate variance and time variance for the direct labour cost. Beside the amount of each variance, write the letter F or U to indicate whether the variance is favourable or unfavourable.

Direct Labour Cost Variances

Rate variance:			Variance
Actual rate	$		
Standard rate	$		
Variance	$	per hr. x actual time,	$
Time variance:			
Actual time		hrs.	
Standard time		hrs.	
Variance		hrs. x standard rate $	
Total direct labour cost variance			$

(3) Determine the controllable variance and the volume variance for the factory overhead cost. Beside the amount of each variance, write the letter F or U to indicate whether the variance is favourable or unfavourable.

Factory Overhead Cost Variances

			Variance
Controllable variance:			
Actual variable factory overhead cost incurred	$		
Budgeted variable factory overhead for standard product produced	$		
Variance			$
Volume variance:			
Budgeted hours at 100% of normal capacity		hrs.	
Standard hours for amount produced		hrs.	
Productive capacity not used		hrs.	
Standard fixed factory overhead cost rate	$		
Variance			
Total factory overhead cost variance			$

PROBLEM 23–2

The following data were taken from the records of Piazza Company Inc. for January of the current year:

Administrative expenses	$ 42,000
Selling expenses	68,000
Cost of goods sold (at standard)	812,000
Fixed factory overhead volume variance—unfavourable	10,000
Variable factory overhead controllable variance—favourable	4,000
Direct materials quantity variance—unfavourable	1,500
Direct materials price variance—unfavourable	500
Direct labour time variance—favourable	3,000
Direct labour rate variance—unfavourable	1,200
Sales	995,000

Instructions: Prepare an income statement for presentation to management.

Piazza Company, Inc.

Income Statement

For the Month Ended January 31, 20—

24 Performance Evaluation for Decentralized Operations

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 24.

1. Many new terms are introduced in this chapter. You can expect true/false, multiple-choice, or matching questions testing your knowledge of these terms. Study the Key Terms to prepare for such questions.
2. The major focus of this chapter is responsibility accounting. Budget performance reports for cost centres have been discussed in earlier chapters, therefore, expect some multiple-choice questions on cost centres. You will probably not have to prepare a budget performance report. You can expect questions requiring you to determine the amount of service department expenses to charge to a profit centre, and to calculate controllable operating income. For investment centres, you should be able to compute rate of return on investment (including the profit margin and investment turnover), and residual income. The Illustrative Problem in the Chapter Review is a good study aid for these computations.
3. This chapter also discusses transfer pricing. Most instructors use multiple-choice questions to cover this topic on tests and quizzes.

CHAPTER OUTLINE

I. Centralized and Decentralized Operations.

- **A.** A completely centralized business is one in which all major planning and operating decisions are made by top management.
- **B.** Separating a business into divisions or operating units and delegating responsibility for these units to managers is called decentralization.
- **C.** In a decentralized business, the unit managers are responsible for planning and controlling operations.
  1. In a decentralized business, the unit managers have the authority to make decisions without first seeking the approval of top management.
  2. The amount of decentralization varies significantly, and there is no one best level of decentralization for all businesses.

D. Numerous advantages exist for decentralized organizations.

1. Delegating authority to managers closest to the operations usually results in better decisions. These managers often anticipate and react to operating data more quickly than top management.
2. Decentralization allows managers to focus on acquiring expertise in their areas of responsibility.
3. Decentralized decision making provides excellent training for managers.
4. Decentralization often improves the ability of a business to serve customers and respond to their needs. This helps create good customer relations.
5. Decentralized managers tend to identify more closely with customers and the operations for which they are responsible. Often they are more creative in suggesting operating and product improvements.

E. Several disadvantages also exist for decentralized organizations.

1. The primary disadvantage is that a decision made by one manager may affect other managers in such a way that the profitability of the entire company may suffer.
2. Other potential disadvantages may be the duplication of various assets and costs in the operating divisions.

F. In a decentralized business, areas of responsibility are called responsibility centres.

G. Responsibility accounting is the process of measuring and reporting operating data by responsibility centre.

H. The three common types of responsibility centres are cost centres, profit centres, and investment centres.

II. Responsibility Accounting for Cost Centres

A. In a cost centre, the department or division manager has responsibility and authority for controlling the costs incurred.

1. An example of a cost centre would be a power department whose supervisor has responsibility for the costs incurred in providing power.
2. Cost centres may vary in size from a small department to an entire manufacturing plant.
3. Cost centres may exist within other cost centres.

B. Normally, budget performance reports are part of a responsibility accounting system for a cost centre.

1. The amount of detail presented in a budget performance report depends upon the level of management to which the report is directed.
2. The reports prepared for the department supervisors present details of the budgeted and actual manufacturing costs for their departments. These reports and other more detailed information can be used by supervisors to focus on the items that created significant differences.

3. Budget performance reports for plant managers contain summarized data on the budgeted and actual costs of the departments under their jurisdiction.

III. Responsibility Accounting for Profit Centres.

A. In a profit centre, the manager has responsibility and authority to make decisions that affect both costs and revenues (and thus profits) for the department, division, or product.

1. An example of a profit centre is a division of a consumer product company where each division manager has authority for costs and the determination of sales prices for a product line.
2. Profit centres are often viewed as an excellent training assignment for new managers.

B. Responsibility accounting reports for profit centres are normally in the form of income statements. The profit centre income statement should include only revenues and expenses controlled by the manager.

C. Controllable revenues are revenues earned by the profit centre. Controllable expenses are costs that can be influenced (controlled) by the decisions of profit centre managers.

D. Profit centre income and performance reporting often focuses on operating income. The operating income is determined by subtracting operating expenses from revenues. Operating expenses incurred only for the benefit of a particular profit centre are direct expenses.

E. Services may be provided more efficiently by internal service departments than by outside service firms.

1. When the costs of services are charged to a profit centre, based on its use of those services, they are called service department charges. These charges are indirect expenses to a profit centre.
2. The activity base of the service departments is used to charge service expenses to company divisions. The rates at which services are charged to each division are called service department charge rates.

F. The divisional income statements also show the service department charges to the divisions. The operating income less the service department charges is called controllable operating income. In evaluating the profit centre manager, the controllable operating income should be compared to historical performance or to the budget.

IV. Responsibility Accounting for Investment Centres.

A. In an investment centre, the manager has responsibility and authority to make decisions that affect not only costs and revenues, but also the assets invested in the centre.

1. Investment centres are widely used in highly diversified companies and typically are organized as divisions.
2. The manager of an investment centre occupies a position similar to that of a chief operating officer or president of a separate company.

B. Since investment centre managers have responsibility for revenues and expenses, controllable operating income is an essential part of investment centre reporting.

1. Controllable operating income by division (investment centre) is determined by subtracting operating expenses from revenues to yield operating income and then subtracting service department charges from the operating income to yield controllable operating income.
2. A deficiency of operating income as a measure of investment centre performance is that it does not reflect the amount of assets invested in each centre.

C. One of the most widely used measures of divisional performance is the rate of return on investment (ROI), also referred to as rate of return on assets.

1. The rate of return on investment is computed as follows:

$$\text{Rate of Return on Investment (ROI)} = \frac{\text{Controllable Operating Income}}{\text{Invested Assets}}$$

2. The basic rate of return on investment formula may be expanded to encompass two additional factors for analysis. This expanded form of the rate of return on investment formula is as follows:

$$\text{Rate of Return on Investment (ROI)} = \frac{\text{Controllable Operating Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Invested Assets}}$$

3. The profit margin component (controllable operating income divided by sales) of the ROI formula focuses on profitability by indicating the rate of profit earned on each sales dollar.
4. The investment turnover component (sales divided by invested assets) of the ROI formula focuses on efficiency in using assets and indicates the rate at which sales are generated for each dollar of invested assets.
5. By increasing either the profit margin or the investment turnover, a division may increase its rate of return on investment (ROI).
6. The major advantage of using the rate of return on investment (ROI) instead of operating income as a divisional performance measure is that the amount of divisional investment is directly considered. Thus, divisional performances can be compared, even though the sizes of the divisions may vary significantly.

7. In considering a decision to expand operations of a division, management should give priority to expanding divisions with the highest ROI.
8. A disadvantage of the rate of return on investment as a performance measure is that it may lead divisional managers to reject new investments, even though the ROI on these proposals exceeds the minimum considered acceptable by the company. For example, a division manager with an ROI of 25% would likely reject an investment proposal earning an ROI of 20%, even though the business minimum ROI is 15%.

D. Residual income as an investment centre performance measure is useful in overcoming some of the disadvantages associated with the rate of return on investment.

1. Residual income is the excess of controllable operating income over a minimum amount of desired controllable operating income.
2. The minimum amount of desired controllable operating income is set by top management by establishing a minimum rate of return for the invested assets, and then multiplying this rate by the amount of divisional assets.
3. The major advantage of residual income as a performance measure is that it gives consideration not only to a minimum rate of return on investment, but also to the total amount of the controllable operating income earned by each division.

E. In addition to ROI or residual income, many businesses are using non-financial measures to assess the performance of investment centres. These performance measures include product quality, customer complaints, warranty experience, customer retention rates, product availability, on-time performance, and the like.

V. Transfer Pricing.

A. When decentralized divisions transfer products or render services to each other, a transfer price is used to charge for the products or services.

B. The objective of transfer pricing is to encourage each division manager to transfer goods and services between divisions if overall company income can be increased by doing so.

C. Three commonly used approaches to transfer pricing are the market price approach, the negotiated price approach, and the cost price approach.

D. Under the market price approach, the transfer price is the price at which the product or service transferred could be sold to outside buyers.

1. The market price approach to transfer pricing is appropriate if the division supplying the product or service is operating at full capacity and can sell all it produces.
2. In this situation, the use of the market price as the transfer price has no effect on the income of the divisions or the total company income.

E. If unused or excess capacity exists in the supplying division, the use of the market price approach may not maximize total company profit. This is because the manager of the buying division will be indifferent as to whether to purchase materials from within the company or from outside suppliers. If the manager purchases from outside, total company profits will not be maximized. In this case, the negotiated price approach is often used.

1. The negotiated price approach allows the divisional managers of the decentralized units to agree (negotiate) among themselves as to the transfer price.
2. The only constraint on the negotiations is that the negotiated transfer price be less than the market price but greater than the supplying division's variable costs per unit.
3. If agreement cannot be reached between the division managers, the company's top management may intervene to set the transfer price.

F. Under the cost price approach, cost is used as the basis for setting the transfer prices.

1. A variety of cost concepts may be used, such as total product cost per unit or variable product cost per unit.
2. Either actual cost or standard (budgeted) cost may be used; however, standard cost is usually preferable.
3. When division managers have responsibility only for cost centres, the cost price approach to transfer pricing is appropriate and is often used.
4. The cost price approach may be inappropriate when decentralized operations are organized as profit or investment centres, since the supplying division would be prevented from reporting any operating income from the transfers.

ILLUSTRATIVE PROBLEM

Reese Company has two divisions, A and B. Invested assets and condensed income statement data for each division for the past year ended December 31 are as follows:

	Division A	Division B
Sales	$3,125,000	$5,100,000
Cost of goods sold	2,500,000	4,000,000
Operating expenses	150,000	590,000
Invested assets	2,500,000	3,000,000

Instructions

1. Prepare condensed income statements for the past year for each division.
2. Using the expanded expression, determine the profit margin, investment turnover, and rate of return on investment for each division.
3. If management desires a minimum rate of return of 12%, determine the residual income for each division.

Solution

1.

Reese Company
Divisional Income Statements
For Year Ended December 31, 20—

	Division A	Division B
Sales	$3,125,000	$5,100,000
Cost of goods sold	2,500,000	4,000,000
Gross profit	$ 625,000	$1,100,000
Operating expenses	150,000	590,000
Controllable operating income	$ 475,000	$ 510,000

2.

Rate of Return on Investment (ROI) = Profit Margin x Investment Turnover

$$ROI = \frac{\text{Controllable Operating Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Invested Assets}}$$

Division A:

$$ROI = \frac{475{,}000}{\$3{,}125{,}000} \times \frac{\$3{,}125{,}000}{\$2{,}500{,}000}$$

$$ROI = 15\% \times 1.25$$

$$ROI = 19\%$$

Division B:

$$ROI = \frac{\$510{,}000}{\$5{,}100{,}000} \times \frac{\$5{,}100{,}000}{\$3{,}000{,}000}$$

$$ROI = 10\% \times 1.7$$

$$ROI = 19\%$$

3. Division A: $175,000 ($475,000 - $300,000)

Division B: $150,000 ($510,000 - $360,000)

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A. Controllable expenses
B. Controllable operating income
C. Cost centre
D. Cost price approach
E. Decentralization
F. Division
G. Investment centre
H. Investment turnover
I. Market price approach
J. Negotiated price approach
K. Operating income
L. Profit centre
M. Profit margin
N. Rate of return on investment
O. Residual income
P. Service department charges
Q. Responsibility accounting
R. Transfer price

_____ 1. An accounting process of measuring and reporting operating data by areas of responsibility.

_____ 2. The separation of a business into more manageable operating units.

_____ 3. A decentralized unit in which the manager has responsibility for the control of costs incurred and the authority to make decisions that affect these costs.

_____ 4. A decentralized unit in which the manager has responsibility and authority to make decisions that affect not only costs and revenues, but also the capital assets available to the centre.

_____ 5. A decentralized unit in which the manager has responsibility and authority to make decisions that affect both costs and revenues.

_____ 6. A component of the rate of return on investment.

_____ 7. Controllable operating income divided by invested assets.

_____ 8. Controllable operating income divided by sales.

_____ 9. The excess of controllable operating income over a "minimum" amount of desired controllable operating income.

_____ 10. An approach to transfer pricing that uses the price at which the product or service transferred could be sold to outside buyers as the transfer price.

_____ 11. The price charged one decentralized unit by another for the goods or services provided.

_____ 12. Costs that can be influenced by the decisions of a manager.

_____ 13. Revenues less operating expenses for a profit or investment centre.

_____ 14. An approach to transfer pricing that uses cost as the basis for setting the transfer price.

_____ 15. The costs of services provided by an internal service department and transferred to a responsibility centre.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

		True	False
1.	A primary disadvantage of decentralized operations is that decisions made by one manager may affect other managers in such a way that the profitability of the entire company may suffer.		
2.	A transfer price is the price charged one decentralized unit by another for the goods or services provided.		
3.	In an investment centre, the manager has responsibility and authority to make decisions that affect not only costs and revenues, but also the capital assets available to the centre.		
4.	Responsibility accounting reports for cost centres contain the same amount of detail, regardless of the level of operations to which the report is addressed.		
5.	An approach to transfer pricing that uses costs as the basis for setting the transfer price is the cost price approach		
6.	The primary responsibility accounting report for a cost centre is the income statement.		
7.	Three measures of investment centre performance are rate of return on investment, residual income, and controllable operating income.		
8.	Rate of return on investment as a measure of investment centre performance reflects not only the revenues and costs of the division, but also the amount of invested assets.		
9.	The rate of return on investment is computed by dividing sales by invested assets.		
10.	The rate of return on investment can be computed by multiplying the profit margin by the operating profit.		
11.	The investment turnover is computed by dividing sales by invested assets.		
12.	If the rate of return on investment is 18% and the investment turnover is 3, the profit margin is 9%.		
13.	If the divisional profit margin decreases and the investment turnover increases, the rate of return on investment will always increase.		
14.	The negotiated price approach is an approach to transfer pricing that allows managers of decentralized units to agree among themselves as to the transfer price.		

	True	False
15. If the divisional profit margin decreases and the investment turnover remains unchanged, the rate of return on investment will decrease	_____	_____
16. The market approach to transfer pricing should be used when the transferring division has excess capacity. . .	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. When the manager has responsibility and authority to make decisions that affect costs, but no responsibility or authority over revenues and assets invested in the department, the department is referred to as:
   a. a cost centre
   b. a profit centre
   c. an investment centre
   d. none of the above

2. If a division organized as a profit centre has excess capacity, the most appropriate approach to setting the transfer price is:
   a. market price
   b. negotiated price
   c. cost price
   d. marginal price

3. Which of the following expressions is frequently referred to as the profit margin factor in determining the rate of return on investment?
   a. controllable operating income divided by invested assets
   b. sales divided by invested assets
   c. controllable operating income divided by sales
   d. none of the above

4. The manager of which of the following centres has the most authority and responsibility?
   a. cost centre
   b. profit centre
   c. data centre
   d. investment centre

5. Division F has sales of $750,000; cost of goods sold of $450,000; operating expenses of $228,000; and invested assets of $300,000. What is the rate of return on investment of Division F?
   a. 9.6%
   b. 10%
   c. 20%
   d. 24%

6. Division F has sales of $750,000; cost of goods sold of $450,000; operating expenses of $228,000; and invested assets of $300,000. What is the investment turnover of Division F?
   a. 1.7
   b. 2.5
   c. 4.2
   d. 10.4

7. The profit margin for Division Q is 15% and the investment turnover is 1.2. What is the rate of return on investment for Division Q?
   a. 12.5%
   b. 15%
   c. 18%
   d. 20%

EXERCISE 24-1

Condensed income statements for Divisions M and N of Perlita Inc. and the amount invested in each division are as follows:

		Division M		Division N
Sales		$ 500,000	(c)	$
Cost of goods sold	(a)			275,00
Gross profit		$ 220,000		$ 245,000
Operating expenses		100,000	(d)	
Controllable operating income	(b)	$		$ 110,000
Invested assets		$ 750,000		$ 500,000

Instructions

(1) Insert the amounts of the missing items (a) - (d) in the condensed divisional income statements above.

(2) Determine the rate of return on investment for each division.

(3) On the basis of controllable operating income, which division is more profitable?

(4) On the basis of rate of return on investment, which division is more profitable?

EXERCISE 24–2

Based on the data in Exercise 24-1, assume that Perlita Inc. has established a minimum rate of return for invested assets at 12%.

Instructions

(1) Determine the residual income for each division of Perlita.

(2) On the basis of residual income, which division is more profitable?

EXERCISE 24-3

One item is omitted from each of the following computations of the rate of return on investment:

Rate of Return on Investment	=	Profit Margin	×	Investment Turnover
16%		10%		(a) _____
17.5%		(b) _____		1.4
(c) _____		21%		0.9
21.6%		(d) _____		1.2
24%		16%		(e) _____

Instructions: Determine the missing items.

PROBLEM 24-1

The budget for Department F of Plant 7 for the current month ended July 31 is as follows:

Factory wages	$ 65,000
Materials	39,500
Supervisory salaries	15,000
Power and light	8,900
Amortization of capital equipment	7,500
Maintenance	4,300
Insurance and property taxes	2,000

During July, the costs incurred in Department F of Plant 7 were: factory wages: $73,600; materials, $37,700; supervisory salaries, $15,000; power and light, $9,600; amortization of capital equipment, $7,500; maintenance, $3,900; and insurance and property taxes, $2,000.

Instructions: Prepare a budget performance report for the supervisor of Department F, Plant 7, for the month of July, using the following form:

Budget Performance Report—Supervisor, Department F, Plant 7

For Month Ended July 31, 20—

	BUDGET	ACTUAL	OVER	UNDER

PROBLEM 24-2

Instructions: Using the following information, complete the income statement for Divisions J and K of Firefly Co.

(1)	Division J sales	$280,000
	Division K sales	420,000
(2)	Cost of J sales	122,500
	Cost of K sales	227,500

The following expenses should be charged directly to the two divisions on the following bases:

(3) Corporate Service Department	Amount	Basis for Charging
Payroll accounting	$60,000	Number of payroll cheques
Central purchasing	88,000	Number of requisitions
Brochures	50,000	Number of brochure pages

	Number of Payroll Cheques	Number of Requisitions	Number of Brochure Pages
Division J	400	2,000	500
Division K	600	1,500	200
Corporate	200	500	100
Total	1,200	4,000	800

(4) General corporate overhead (administration) should be allocated on the basis of divisional sales. Sales expenses totalled $120,000.

(5) The following items are not allocable to the divisions:

Interest expense	$14,000
Income tax	8,000

Firefly Co.

Income Statement—Divisions J and K

For the Year Ended May 31, 20—

Net sales
Cost of goods sold
Gross profit
Direct charged expenses:
Payroll accounting
Purchasing
Brochure advertising
Total direct service department expenses
Controllable operating income
Indirect allocated expenses:
Sales
Corporate administration
Division income
Other expense:
Interest expense
Income before income tax
Income tax
Net income

PROBLEM 24-3

TP Co. has two manufacturing divisions, X and Y. Division X currently purchases 10,000 units of materials from an outside supplier at $30 per unit. The same materials are produced by Division Y at a variable cost of $22 per unit. Division Y is operating at full capacity of 40,000 units and can sell all it produces either to outside buyers at $30 or to Division X.

Instructions

(1) Assume that Division Y sells 10,000 units of its product to Division X rather than to outside buyers. If the sale is made at a market price of $30, what will be the effect on:

(a) Division X's controllable operating income?

_____increase by $_____

_____decrease by $_____

_____no effect

(b) Division Y's controllable operating income?

_____increase by $_____

_____decrease by $_____

_____no effect

(2) Assume that Division Y sells 40,000 units of product at $30 to outside buyers and still has excess capacity of 10,000 units. If 10,000 units of product are sold to Division X at a negotiated transfer price of $27, what will be the effect on:

(a) Division X's controllable operating income?

_____increase by $_____

_____decrease by $_____

_____no effect

(b) Division Y's controllable operating income?

_____increase by $_____

_____decrease by $_____

_____no effect

(3) Assume the same facts as in (2), but use a negotiated transfer price of $20. What will be the effect on:

(a) Division X's controllable operating income?

_____increase by $_____

_____decrease by $_____

_____no effect

(b) Division Y's controllable operating income?

_____increase by $_____

_____decrease by $_____

_____no effect

25 Differential Analysis and Product Pricing

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 25.

1. Many new terms are introduced in this chapter. You can expect true/false, multiple-choice, or matching questions testing your knowledge of these terms. Study the Key Terms in preparing for such questions.
2. You can expect short problems testing your ability to perform differential analysis for one or more of the six types of differential analysis illustrations presented in the chapter. Part 5 of the Illustrative Problem in the Chapter Review is a useful study aid for differential analysis of accepting additional business at a special price.
3. You also are likely to see a short problem applying the cost-plus approach to setting product prices. Remember that there are three versions of the cost-plus approach: total cost, product cost, and variable cost.
4. If your instructor emphasized product pricing under production bottlenecks, you might also see a short problem in that area. At least be able to compute the contribution margin per bottleneck hour and describe how this information is used to adjust the product price.

Chapter Outline

I. Differential Analysis.

A. The revenue and cost data needed to evaluate courses of future operations or to choose among competing alternatives are often not available in the accounting records and often must be estimated.

B. The relevant revenues and costs focus on the differences between the alternatives being considered. Costs that have been incurred in the past are not relevant to the decision and are called sunk costs.

C. Differential revenue is the amount of increase or decrease in revenue expected from a course of action as compared with an alternative.

D. Differential cost is the amount of increase or decrease in cost that is expected from a particular course of action as compared with an alternative.

E. Differential income or loss is the difference between the differential revenue and the differential costs.

F. The area of accounting concerned with the effect of alternative courses of action on the relevant revenues and costs is called differential analysis.

G. Differential analysis can be used in deciding between leasing or selling a piece of equipment that is no longer needed in the business.

1. The differential revenues from the lease versus the sale are presented first.
2. The differential costs of the alternatives are presented next.
3. The net advantage of the lease or sale is then determined by subtracting the differential cost from the differential revenue.
4. The book value of the equipment is a sunk cost and is not considered in the analysis.

H. Differential analysis can be used in assessing whether a department, branch, territory, or other segment of the business that has been operating at a loss should be eliminated or discontinued.

1. Differential revenue from the sales of the segment is determined first.
2. The differential cost of sales of the segment, which includes only the variable cost of goods sold and operating expenses, is determined.
3. The annual differential income or loss from the sales of the segment is then determined.
4. In decisions involving the elimination of a production segment, management must also consider other factors, such as its effect on employees and customers.

I. Differential analysis may be used in determining whether the business should make or buy a part used in its manufacturing operations.

1. The differential cost to buy the part is the purchase price of the part from the outside suppliers.
2. The differential cost to manufacture the part includes direct materials, direct labour and variable factory overhead, assuming the business has unused capacity.
3. The net cost increase or savings from manufacturing the part can then be determined.

J. Differential analysis can be used in assessing whether to replace manufacturing equipment before it is worn out or obsolete.

1. The differential costs to be considered include the variable costs of manufacturing the product using the current equipment.
2. Any proceeds from the sale of the current equipment should be added, and the cost of the new equipment should be subtracted in determining the net differential cost increase or decrease from purchasing the new equipment.
3. The amount of income that is forgone from use of cash is called the opportunity cost. Opportunity cost is often used to analyze different courses of action.

K. Differential analysis can be used in deciding whether to process further or sell a manufactured product in various stages of production.

1. The differential revenue to be considered includes the revenue from the sale of the product at the intermediate stage of production and the revenue from the sale of the product that has been processed further.
2. The differential revenues from further processing are compared to the differential costs of further processing.

L. Differential analysis is also useful in deciding whether to accept additional business at a special price.

1. The differential revenue from the acceptance of an offer at a special price is the sale of the additional units at that special price.
2. The differential cost of acceptance of the offer includes the variable costs of manufacturing the additional units, if the business is operating below full capacity.
3. The net gain or loss from the acceptance of the offer can then be determined.
4. Before accepting business at a special price, a business should consider the effect on other sales, and the legality of the pricing.

II. Setting Normal Product Selling Prices.

A. The normal selling price can be viewed as the target selling price to be achieved in the long run. The two basic approaches to setting the normal selling price are the market methods and cost-plus methods.

B. Under the market methods, managers refer to the external market to determine the price. Demand-based methods set the price according to the prices offered by competitors.

C. Using the cost-plus approach, product prices are determined by adding to a "cost" amount a plus, called a markup, so that all costs plus a profit are included in the selling price.

D. Three cost concepts commonly used in applying the cost-plus approach are: total cost, product cost, and variable cost.

E. Using the total cost concept, all costs of manufacturing a product plus the selling and administrative expenses are included in the cost amount to which the markup is added.

1. Since all costs and expenses are included in the cost amount, the dollar amount of the markup equals the desired profit.
2. The markup percentage for the total cost concept is determined by applying the following formula:

   Markup Percentage = Desired Profit / Total Costs

3. The total cost concept of applying the cost-plus approach to product pricing is often used by contractors who sell products to government agencies. In many cases, government contractors are required by law to be reimbursed for their products on a total-cost-plus-profit basis.

F. Using the product cost concept, only the costs of manufacturing the product, termed the product cost, are included in the cost amount to which the markup is added.

1. The markup percentage for the product cost concept is determined by applying the following formula:

$$\text{Markup Percentage} = \frac{\text{Desired Profit + Total Selling and Administrative Expenses}}{\text{Total Manufacturing Costs}}$$

2. The numerator of the markup percentage formula includes the desired profit plus the total selling and administrative expenses. The selling and administrative expenses must be included in the markup, since they are not included in the cost amount to which the markup is added.

G. Using the variable cost concept, only variable costs are included in the cost amount to which the markup is added.

1. All variable manufacturing costs, as well as variable selling and administrative expenses, are included in the cost amount.

2. Fixed manufacturing costs, fixed selling and administrative expenses, and profit are included in the markup.

3. The markup percentage for the variable cost concept is determined by applying the following formula:

$$\text{Markup Percentage} = \frac{\text{Desired Profit + Total Fixed Costs}}{\text{Total Variable Costs}}$$

H. The three cost concepts commonly used in applying the cost-plus approach to product pricing are summarized on page 1098 of the text.

I. Which of the three cost concepts should be applied by management depends upon such factors as the cost of gathering the data and the decision-making needs of management.

J. A variation of the cost concepts discussed in the preceding paragraphs is the target cost concept.

1. Under this concept the selling price is assumed to be set by the marketplace. The target cost is determined by subtracting a satisfactory profit from a given selling price.

2. The product is then designed, manufactured, and sold to achieve the target cost.

K. Costs are an important consideration in setting product prices. To more accurately measure the costs of producing and selling products, some companies have implemented activity-based costing (ABC).

1. ABC focuses on identifying and tracing activities to specific products.

2. ABC may be useful in making product pricing decisions where diverse and complex manufacturing operations involve large amounts of factory overhead. In such cases, conventional overhead allocation methods may distort product costs and thus, product prices.

III. Product Profitability and Pricing Under Production Bottlenecks.

A. A production bottleneck (or constraint) occurs when the demand for a company's product exceeds the ability to produce the product. The theory of constraints (TOC) is a manufacturing strategy that focuses on reducing the influence of bottlenecks on a process.

B. When a company has a bottleneck in its production process, it should attempt to maximize its profitability, subject to the influence of the bottleneck.

C. Contribution margin per unit can be a misleading indicator of profitability in a bottleneck operation. The correct measure of performance is the value of each bottleneck hour, or the contribution margin per bottleneck hour.

D. When a company has a production bottleneck, the contribution margin per bottleneck hour provides a measure of the product's relative profitability. This information can be used to adjust the product price to better reflect the value of the product's use of a bottleneck.

Illustrative Problem

Berry Company recently began production of a new product, M, which required the investment of $2,000,000 in assets. The costs of producing and selling 100,000 units of Product M are estimated as follows:

Variable costs:	
Direct materials	$ 2.40 per unit
Direct labour	6.50
Factory overhead	.90
Selling and administrative expenses	.20
Total	$10.00 per unit
Fixed costs:	
Factory overhead	$ 60,000
Selling and administrative expenses	140,000

Berry Company is currently considering establishing a selling price for Product M. The president of Berry Company has decided to use the cost-plus approach to product pricing and has indicated that Product M must earn an 18% rate of return on invested assets.

Instructions

1. Determine the amount of desired profit from the production and sale of Product M.
2. Assuming that the total cost concept is used, determine (a) the cost amount per unit, (b) the markup percentage, and (c) the selling price of Product M.
3. Assuming that the product cost concept is used, determine (a) the cost amount per unit, (b) the markup percentage, and (c) the selling price of Product M.
4. Assuming that the variable cost concept is used, determine (a) the cost amount per unit, (b) the markup percentage, and (c) the selling price of Product M.

5. Assume that for the current year, the selling price of Product M was $15.60 per unit. To date, 80,000 units have been produced and sold, and analysis of the domestic market indicates that 15,000 additional units are expected to be sold during the remainder of the year. Recently, Berry Company received an offer from Wong Inc. for 4,000 units of Product M at $11.50 each. Wong Inc. will market the units in Korea under its own brand name, and no additional selling and administrative expenses associated with the sale will be incurred by Berry Company. The additional business is not expected to affect the domestic sales of Product M, and the additional units could be produced during the current year, using existing capacity. (a) Prepare a differential analysis report of the proposed sale to Wong Inc. (b) Based upon the differential analysis report in (a), indicate if the proposal should be accepted.

Solution

1. $360,000 ($2,000,000 x 18%)

2. a. Total costs:

Variable ($10 x 100,000 units)	$1,000,000
Fixed ($60,000 + $140,000)	200,000
Total	$1,200,000

Cost amount per unit: $1,200,000 / 100,000 units = $12

b. $$\text{Markup Percentage} = \frac{\text{Desired Profit}}{\text{Total Costs}}$$

$$= \frac{\$360,000}{\$1,200,000} = 30\%$$

c.

Cost amount per unit	$ 12.00
Markup ($12 x 30%)	3.60
Selling price	$ 15.60

3. a. Total manufacturing costs:

Variable ($9.80 x 100,000 units)	$ 980,000
Fixed factory overhead	60,000
Total	$1,040,000

Cost amount per unit: $1,040,000 / 100,000 units = $10.40

b. Markup Percentage $= \dfrac{\text{Desired Profit + Total Selling and Administrative Expenses}}{\text{Total Manufacturing Costs}}$

$= \dfrac{\$360{,}000 + \$140{,}000 + (\$.20 \times 100{,}000 \text{ units})}{\$1{,}040{,}000}$

$= \dfrac{\$360{,}000 + \$140{,}000 + \$20{,}000}{\$1{,}040{,}000}$

$= \dfrac{\$520{,}000}{\$1{,}040{,}000} = 50\%$

c. Cost amount per unit	$ 10.40
Markup ($10.40 x 50%)	5.20
Selling price	$ 15.60

4. a. Variable cost per unit: $10
Total variable costs: $10 x 100,000 units = $1,000,000

b. Markup Percentage $= \dfrac{\text{Desired Profit + Total Fixed Costs}}{\text{Total Variable Costs}}$

$= \dfrac{\$360{,}000 + \$60{,}000 + \$140{,}000}{\$1{,}000{,}000}$

$= \dfrac{\$560{,}000}{\$1{,}000{,}000} = 56\%$

c. Cost amount per unit	$ 10.00
Markup ($10 x 56%)	5.60
Selling price	$ 15.60

5. a. Proposal to Sell to Wong Inc.

Differential revenue from acceptance of offer:	
Revenue from sale of 4,000 additional units at $11.50	$ 46,000
Differential cost of acceptance of offer:	
Variable costs of 4,000 additional units at $9.80	39,200
Gain from acceptance of offer	$ 6,800

b. The proposal should be accepted.

Matching

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A.	Activity-based costing	I.	Opportunity cost
B.	Bottleneck	J.	Product cost concept
C.	Cost-plus approach	K.	Sunk cost
D.	Differential analysis	L.	Target cost concept
E.	Differential cost	M.	Theory of constraints (TOC)
F.	Differential revenue	N.	Total cost concept
G.	Fixed costs	O.	Variable cost concept
H.	Markup	P.	Variable costs

_____ 1. The area of accounting concerned with the effect of alternative courses of action on revenues and costs.

_____ 2. The amount of increase or decrease in cost expected from a particular course of action as compared with an alternative.

_____ 3. The amount of increase or decrease in revenue expected from a particular course of action as compared with an alternative.

_____ 4. The amount of income forgone from an alternative to a proposed use of cash or its equivalent.

_____ 5. A cost that is not affected by later decisions.

_____ 6. In using the cost-plus approach to product pricing, product prices are determined by adding to a cost amount a plus, called a(n) (?)

_____ 7. Using the (?) concept of applying the cost-plus approach to product pricing, all costs of manufacturing the product plus the selling and administrative expenses are included in the cost amount to which the markup is added.

_____ 8. The (?) concept of applying the cost-plus approach to product pricing includes only the cost of manufacturing the product in the cost amount to which the markup is added.

_____ 9. Using the (?) concept of applying the cost-plus approach to product pricing, only variable costs and expenses are included in the cost amount to which the markup is added.

_____ 10. A cost allocation method that identifies activities causing the incurrence of costs and allocates these costs to products based upon activity drivers (bases).

_____ 11. The cost required to deliver an acceptable profit at a given market-determined price.

_____ 12. A condition that occurs when product demand exceeds production capacity.

_____ 13. A manufacturing strategy that attempts to remove the influence of bottlenecks on a process.

True / False

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

		True	False
1.	In deciding whether to replace capital assets, the book values of the capital assets being replaced are sunk costs and are irrelevant.	_____	_____
2.	The amount of increase or decrease in cost that is expected from a particular course of action as compared with an alternative is called opportunity cost.	_____	_____
3.	In deciding whether to accept business at a special price, a company which is operating below full capacity will decrease its operating income if the special price does not exceed all costs.	_____	_____
4.	Discontinuance of an unprofitable segment of business will usually eliminate all of the related fixed costs. . . .	_____	_____
5.	The amount of income that would result from the best available alternative to the proposed use of cash or its equivalent is sometimes called differential cost.	_____	_____
6.	Using the variable cost concept of applying the cost-plus approach to product pricing, only the desired profit is included in the markup.	_____	_____
7.	Using the total cost concept of applying the cost-plus approach to product pricing, all costs of manufacturing the product plus the selling and administrative expenses are included in the cost amount to which the markup is added.	_____	_____
8.	In differential analysis, two additional factors to be considered in making a lease or sell decision are (1) differential revenue from investing funds generated by alternatives and (2) any income tax differential.	_____	_____
9.	In decisions involving the elimination of a product or segment, management should consider the short-term only.	_____	_____
10.	Using the cost-plus approach to product pricing, managers determine product prices by adding a markup to a cost amount.	_____	_____
11.	Contractors who sell to government agencies often use the total cost approach to product pricing.	_____	_____
12.	The best way to measure product profitability in a production bottleneck environment is with contribution margin.	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. The area of accounting concerned with the effect of alternative courses of action on revenues and costs is called:

a. gross profit analysis
b. capital investment analysis
c. differential analysis
d. cost-volume-profit analysis

2. A business received an offer from an exporter for 10,000 units of product at $18 per unit. The acceptance of the offer will not affect normal production or the domestic sales price. The following data are available:

Domestic sales price	$25
Unit manufacturing costs:	
Variable	16
Fixed	4

What is the amount of gain or loss from acceptance of the offer?

a. $20,000 gain
b. $20,000 loss
c. $50,000 gain
d. $70,000 gain

3. The amount of income that is forgone from the best available alternative to the proposed use of cash or its equivalent is called:

a. sunk cost
b. opportunity cost
c. differential cost
d. opportunity revenue

4. For which cost concept used in applying the cost-plus approach to product pricing are total selling and general expenses and desired profit allowed for in the determination of markup?

a. total cost
b. product cost
c. variable cost
d. none of the above

5. A business produces Product A in batches of 5,000 gallons, which can be sold for $3 per gallon. The business has been offered $5 per finished gallon to process two batches of Product A further into Product B. Product B will require additional processing costs of $7,800 per batch and 10% of the gallons of Product A will evaporate during processing. What is the amount of gain or loss from further processing of Product A?
   a. $12,200 gain
   b. $7,200 gain
   c. $4,400 gain
   d. $600 loss

6. Which of the following cost concepts is not used in applying the cost-plus approach?
   a. product cost
   b. total cost
   c. variable cost
   d. fixed cost

7. Which of the following concepts accepts product price as given by the marketplace?
   a. total cost plús markup concept
   b. variable cost plus markup concept
   c. target cost concept
   d. product cost plus markup concept

8. The Majestic Company's casting operation is a production bottleneck. Majestic produces three products with the following per unit characteristics.

	Product A	Product B	Product C
Sales price	$100	$120	$200
Variable cost per unit	40	50	120
Contribution margin per unit	60	70	80
Fixed cost per unit	10	30	50
Net profit per unit	50	40	30
Casting time	3.5 hrs.	3 hrs.	4 hrs.

   Which product is the most profitable to the company?
   a. Product A
   b. Product B
   c. Product C
   d. Products A and C

EXERCISE 25-1

Walden Transportation Inc. has a truck that it no longer needs. The truck can be sold for $18,000 or it can be leased for a period of 5 years at $4,000 per year. At the end of the lease, the truck is expected to be sold for a negligible amount. The truck cost $50,000 four years ago, and $35,000 amortization has been taken on it to date. To be sold for $20,000, the truck must first be repainted at a cost of $1,200. If the truck is to be leased for the 5-year period, Walden must provide the licenses, which cost $120 per year. The lessee must provide insurance at an annual cost of $200, tires at an estimated annual cost of $600, and repairs that are expected to amount to $2,000 during the 5-year period.

Instructions: Complete the following form to determine which alternative is more advantageous to Walden Transportation Inc. and to determine the amount of that advantage. (Ignore the fact that if the truck is leased, not all of the revenue is received at once.)

Walden Transportation Inc.
Proposal to Lease or Sell Truck

Differential revenue from alternatives:		
Revenue from lease	$	
Revenue from sale		
Differential revenue from lease		$
Differential cost of alternatives:		
License expenses during lease	$	
Repainting expense on sale		
Differential cost of leasing		
Net differential income (loss) from lease alternative		$

EXERCISE 25-2

Tran Inc. has been purchasing metal blades for $14 a set for use in producing food processors. The cost of manufacturing the blades is estimated at $6.75 for direct materials, $5.10 for direct labour, and $1.80 for factory overhead ($1.00 fixed and $.80 variable). Because there is unused capacity available, there would be no increase in the total amount of fixed factory overhead costs if Tran manufactures the blades.

Instructions: Complete the following form to determine whether Tran Inc. should make or buy the blades.

Tran Inc.
Proposal to Manufacture Metal Blades

Purchase price of blades		$
Differential cost to manufacture blades:		
Direct materials	$	
Direct labour		
Variable factory overhead		
Cost savings (increase) from manufacturing blades		$

EXERCISE 25-3

English Chairs Inc. produces a line of rocking chairs in one section of the plant, and stuffed chairs and recliner chairs in other sections. The controller has supplied the following condensed income statement for the year just ended:

English Chairs Inc.
Condensed Income Statement
For Year Ended December 31, 20—

	Stuffed Chairs	Recliner Chairs	Rocking Chairs	Total
Sales	$ 500,000	$ 250,000	$ 350,000	$ 1,100,000
Cost of goods sold:				
Variable costs	$ 250,000	$ 110,000	$ 180,000	$ 540,000
Fixed costs	50,000	30,000	90,000	170,000
Total cost of goods sold	$ 300,000	$ 140,000	$ 270,000	$ 710,000
Gross profit	$ 200,000	$ 110,000	$ 80,000	$ 390,000
Operating expenses:				
Variable expenses	$ 100,000	$ 60,000	$ 75,000	$ 235,000
Fixed expenses	60,000	25,000	43,000	128,000
Total operating expenses	$ 160,000	$ 85,000	$ 118,000	$ 363,000
Income (loss) from operations	$ 40,000	$ 25,000	$ (38,000)	$ 27,000

Instructions: Complete the following form and determine whether the rocking chairs section should be continued.

English Chairs Inc.
Proposal to Discontinue Rocking Chairs
December 31, 20—

Differential revenue from sales of rocking chairs:		
Revenue from sales		$ _____
Differential cost of sales of rocking chairs:		
Variable cost of goods sold	$ _____	
Variable operating expenses	_____	_____
Differential income (loss) from sales of rocking chairs		$ _____

The rocking chairs section probably_____ be continued.

Exercise 25-4

Golub Inc. has a machine which cost $250,000 five years ago and has $155,000 accumulated amortization to date. The company can sell the machine for $83,000 and replace it with a larger one costing $370,000. The variable annual operating cost of the present machine amounts to $65,000. The variable annual operating cost of the new machine is estimated to be $30,000. It is estimated that either machine could be used for seven years from this date, December 31, 20—, and that at the end of the seven-year period neither would have a significant residual value.

Instructions: Complete the following schedule and determine the advisability of replacing the present machine.

Golub Inc.
Proposal to Replace Machine
December 31, 20—

Annual variable costs—present machine	$ _____	
Annual variable costs—new machine	_____	
Annual differential decrease (increase) in variable costs	$ _____	
Number of years applicable	_____	
Total differential decrease (increase) in variable costs	$ _____	
Proceeds from sale of present machine	_____	$ _____
Cost of new machine		_____
Net differential decrease (increase) in cost, seven-year total		$ _____
Annual net differential decrease (increase) in cost—new machine		$ _____

PROBLEM 25-1

Smith Company recently began production of a new product, G, which required the investment of $500,000 in assets. The costs and expenses of producing and selling 50,000 units of Product G are as follows:

Variable costs:	
Direct materials	$1.20 per unit
Direct labour	2.40
Factory overhead	.40
Selling and administrative expenses	1.00
Total	$5.00 per unit
Fixed costs:	
Factory overhead	$35.00
Selling and administrative expenses	15,000

Smith Company is currently considering establishing a selling price for Product G. The president of Smith Company has decided to use the cost-plus approach to product pricing and has indicated that Product G must earn a 12% rate of return on invested assets.

Instructions

(1) Determine the amount of desired profit from the production and sale of Product G.

(2) Assuming that the total cost concept is used, determine (a) the cost amount per unit, (b) the markup percentage and (c) the selling price of Product G.

(a)

(b)

(c)

PROBLEM 25-2

Based upon the data in Problem 25-1, assume that Smith Company uses the product cost concept of product pricing.

Instructions: Determine (1) the cost amount per unit, (2) the markup percentage, and (3) the selling price of Product G. (Round to the nearest cent.)

(1)

(2)

(3)

PROBLEM 25-3

Based upon the data in Problem 25-1, assume that Smith Company uses the variable cost concept of product pricing.

Instructions: Determine (1) the cost amount per unit, (2) the markup percentage, and (3) the selling price of Product G.

(1)

(2)

(3)

PROBLEM 25-4

The Zelda Company produces three products, Products D, E, and F. All three products require heat treatment in a furnace operation. The furnace operation is a production bottleneck. The annual cost of the furnace operation is $180,000. Information about the three products is as follows:

	Product A	Product B	Product C
Sales price per unit	$ 750	$ 600	$ 400
Variable cost per unit	300	350	200
Contribution margin per unit	$ 450	$ 250	$ 200
Fixed cost per unit	200	200	150
Profit per unit	$ 250	$ 50	$ 50
Furnace hours per unit	15	10	8

Instructions: Determine the price for Products E and F that would generate the same profitability as Product D.

26 Capital Investment Analysis

QUIZ AND TEST HINTS

The following hints may be helpful to you in preparing for a quiz or a test over the material covered in Chapter 26.

1. Many new terms are introduced in this chapter. You can expect true/false, multiple-choice, or matching questions testing your knowledge of these terms. Study the Key Terms in preparing for such questions.
2. You can expect some problems requiring you to perform capital investment analysis using each of the four methods illustrated in the chapter. Often, instructors will use multiple-choice questions to test your knowledge of the average rate of return method, cash payback method, and present value index. Short problems will be used to test your knowledge of the net present value method and internal rate of return methods. The chapter illustrations and the Illustrative Problem in the Chapter Review are good study aids.
3. The remaining chapter topics are tested most often using true/false or multiple-choice questions. The Key Points in the Chapter Review are a good, concise review for many of these items.

CHAPTER OUTLINE

I. Nature of Capital Investment Analysis.

- **A.** The process by which management plans, evaluates, and controls investments in capital assets is called capital investment analysis or capital budgeting.
- **B.** Because capital investment decisions normally involve a long-term commitment of funds and thus affect operations for many years, such decisions are some of the most important that management must make.
- **C.** A capital investment program should include a plan for encouraging employees at all levels of a business to submit proposals for capital investments.

II. Methods of Evaluating Capital Investment Proposals.

- **A.** Methods of evaluating capital investment proposals can be grouped into two categories:
  1. Methods that ignore present value.
  2. Present value methods.

B. The two methods that do not use present value concepts are (1) the average rate of return method and (2) the cash payback method.

C. The two methods that use present values are (1) the net present value method and (2) the internal rate of return method. These methods consider the time value of money. The time value of money concept recognizes that an amount of cash invested today will earn income and therefore has value over time.

D. Management often uses a combination of methods in evaluating capital investment proposals.

E. The use of computers in capital investment analysis allows complex calculations to be performed easily and quickly. Computers can also be used to develop models that indicate the effect of changes in key estimates on the evaluation of capital investment proposals.

F. Methods that ignore present value are often useful in evaluating capital investment proposals that have relatively short lives. In such cases, the timing of the cash flows is less important.

G. The expected average rate of return, sometimes called the accounting rate of return, is a measure of the expected income from an investment in capital assets.

1. In computing the average rate of return, the amount of income expected to be earned from the investment is stated as an annual average over the useful life of the investment.
2. The amount of the investment is the original cost of the investment less depreciation taken over the useful life.
3. If straight-line amortization and no residual value are assumed, the average investment is equal to one-half of the original cost.
4. The formula for the determination of the average rate of return is as follows:

Average Rate of Return = Estimated Average Annual Income / Average Investment

5. When several alternative capital investment proposals are considered, the proposals can be ranked by their average rates of return. The higher the rate of return, the more attractive the proposal.
6. The primary advantages of the average rate of return method are its ease of computation, the fact that it includes the amount of income earned over the entire life of the proposal, and its emphasis on accounting income.
7. The main disadvantage is its lack of consideration of the expected cash flows and the timing of these cash flows.

H. The expected period of time that will pass between the date of a capital investment and the complete recovery in cash (or equivalent) of the amount invested is called the cash payback period.

1. The excess of cash flowing in from revenue over the cash flowing out for expenses is termed net cash flow.
2. The time required for the net cash flow to equal the initial outlay for the capital asset is the payback period.

3. If a proposed capital investment has equal annual net cash flows, the estimated payback period is computed by dividing the cost of the investment by the annual net cash flow.
4. If the annual net cash flows are not equal, the cash payback period is determined by summing the annual net cash flows until the cumulative sum equals the amount of the proposed investment.
5. The cash payback method is widely used in evaluating proposals. The shorter the cash payback period, the more desirable the capital investment proposal.
6. Two disadvantages of the cash payback method are its failure to include in the analysis the cash flows occurring after the payback period, and its lack of use of present value concepts.

I. Present value concepts can be divided into the present value of an amount and the present value of an annuity.

1. The present value of an amount is the amount of cash needed today to invest at a specific interest rate to yield a specific amount of cash at a definite future date. The present value of an amount can be determined with the help of a present value of $1 table.
2. An annuity is a series of equal net cash flows at fixed time intervals. The present value of an annuity is the sum of the present values of each cash flow. The calculation can be made with the help of a present value of an annuity table.

J. The net present value method, sometimes referred to as the discounted cash flow method, analyzes capital investment proposals by comparing the initial cash investment value with the present value of the net cash flows.

1. If the net present value of the cash flows expected from a proposed investment at the selected rate equals or exceeds the amount of the initial investment, the proposal is desirable.
2. When alternative proposals of the same amount are being considered, the one with the largest net present value is the most desirable.
3. If alternative proposals involve different amounts of investment, it is useful to prepare a relative ranking of the proposals by using a present value index.
4. The present value index is computed by using the following formula:

$$\text{Present Value Index} = \frac{\text{Total Present Value of Net Cash Flow}}{\text{Amount to be invested}}$$

5. The primary advantage of the discounted cash flow method is that it considers the time value of money.
6. A disadvantage of this method is that the computations are more complex than those for methods that ignore present value. In addition, this method assumes that the cash received from the proposal during its useful life can be reinvested at the rate of return used to compute the present value of the proposal. This assumption may not always be reasonable.

K. The internal rate of return method, sometimes called the time-adjusted rate of return method, uses present value concepts to compute the rate of return from the net cash flows expected from capital investment proposals.

1. The internal rate of return method starts with the net cash flows and, in a sense, works backwards to determine the rate of return expected from the proposals.

2. When equal annual net cash flows are expected from a proposal, the internal rate of return can be determined using the following procedures:

a. A present value factor for an annuity of $1 is determined by dividing the amount to be invested by the annual net cash flow, as expressed in the following formula:

$$\text{Present Value Factor for an Annuity of \$1} = \frac{\text{Amount to be Invested}}{\text{Equal Annual Net Cash Flows}}$$

b. The present value factor determined in (a) is located in the present value of an annuity of $1 table by first locating the number of years of expected useful life of the investment in the Year column and then proceeding horizontally across the table until the present value factor determined in (a) is found.

c. The internal rate of return is then identified by the heading of the column in which the present value factor in (b) is located.

3. A proposal is acceptable if the internal rate of return is greater than the minimum acceptable rate of return.

4. When several proposals are under consideration, management often ranks the proposals by their internal rates of return, and the proposal with the highest rate is considered the most desirable.

5. The primary advantage of the internal rate of return method is that the present values of the net cash flows over the entire useful life of the proposal are considered. An additional advantage of the method is that all proposals are automatically placed on a common basis for comparison.

6. The primary disadvantage of the internal rate of return method is that the computations are somewhat more complex than for other methods. In addition, this method assumes that the cash received from a proposal during its useful life will be reinvested at the internal rate of return. This assumption may not always be reasonable.

III. Qualitative Considerations in Capital Investment Analysis.

A. Qualitative considerations that may impact upon capital investment analysis include the strategic importance of the investment, the impact of investment proposals on product quality, manufacturing flexibility, employee morale, manufacturing productivity, and manufacturing control.

B. Many of the qualitative factors may be as important as, if not more important than, the results of quantitative analysis.

C. In the current manufacturing environment, it is essential that qualitative factors be carefully considered in capital investment analysis.

IV. Factors That Complicate Capital Investment Analysis.

A. The impact of the federal income tax on capital investment decisions can be significant.

B. When alternative capital investment proposals have unequal useful lives, an adjustment must be made in the analysis to make the proposals comparable.

1. One method is to adjust the lives of the proposals with the longest lives to be equal to the life of the proposal with the shortest life.

2. In this process, the projects with the longest lives are adjusted by using their estimated residual values at the end of the project with the shortest life.

C. Rather than purchase a capital asset, the leasing of capital assets is common in many industries and should be considered.

D. All capital investment analyses rely on factors that are uncertain, such as estimates involving expected revenues, expenses, and cash flows. Errors in one or more estimates can lead to incorrect decisions.

E. The effects of changes in price levels (increasing price levels are referred to as inflation) may have a significant impact on the estimates used in capital investment analysis.

V. Capital Rationing.

A. Capital rationing refers to the process by which management allocates available investment funds among competing capital investment proposals.

B. The flow chart in Exhibit 12 of the chapter portrays the capital rationing process.

C. Proposals that are funded in the capital rationing process are included in the capital expenditures budget to aid the planning and financing of operations.

ILLUSTRATIVE PROBLEM

The capital investment committee of Bormann Company is currently considering two projects. The estimated operating income and net cash flows expected from each project are as follows:

	Project A		Project B	
Year	Operating Income	Net Cash Flow	Operating Income	Net Cash Flow
1	$ 9,000	$19,000	$ 5,000	15,000
2	7,000	17,000	6,000	16,000
3	6,000	16,000	8,000	18,000
4	5,000	15,000	7,000	17,000
5	3,000	13,000	4,000	14,000
	$ 30,000	$ 80,000	$ 30,000	80,000

Each project requires an investment of $50,000. Straight-line amortization will be used, and no residual value is expected. The committee has selected a rate of 15% for purposes of the net present value analysis.

Instructions

1. Compute the following:
   a. The average rate of return for each project, giving effect to amortization on the investment.
   b. The net present value for each project. Use the present value of $1 table appearing in the text chapter.
2. Prepare a summary for the capital investment committee, advising it on the relative merits of the two projects.

Solution

1. a. Average annual rate of return for both projects:

$$\frac{\$30{,}000 \div 5}{(\$50{,}000 + \$0) \div 2} = 24\%$$

   b. Net present value analysis:

Year	Present Value of $1 at 15%	Net Cash Flow		Present Value of Net Cash Flow	
		Project A	Project B	Project A	Project B
1	.870	$ 19,000	$ 15,000	$ 16,530	$ 13,050
2	.756	17,000	16,000	12,852	12,096
3	.658	16,000	18,000	10,528	11,844
4	.572	15,000	17,000	8,580	9,724
5	.497	13,000	14,000	6,461	6,958
Total		$ 80,000	$ 80,000	$ 54,951	$ 53,672
Amount to be invested				$ 50,000	50,000
Net present value				$ 4,951	$ 3,672

2. a. Both projects offer the same average annual rate of return.
   b. Although both projects exceed the selected rate established for the net present value analysis, Project A offers a larger net present value. Thus, if only one of the two projects can be accepted, Project A would be the more attractive.

MATCHING

Instructions: A list of terms and related statements appear below. From the list of terms, select the one that relates to each statement. Print its identifying letter in the space provided.

A.	Annuity	J.	Inflation
B.	Average rate of return	K.	Internal rate of return method
C.	Budget index	L.	Net present value method
D.	Capital expenditures budget	M.	Present value concept
E.	Capital investment analysis	N.	Present value index
F.	Capital rationing	O.	Present value of an annuity
G.	Cash flow budget	P.	Present value methods
H.	Cash payback period	Q.	Price index
I.	Differential analysis	R.	Time value of money concept

_____ 1. Sometimes called the accounting rate of return, it is a measure of the expected income from an investment in capital assets.

_____ 2. The process by which management plans, evaluates, and controls investments involving property, plant, and equipment.

_____ 3. This method of evaluating capital investment proposals uses present value concepts to compute the rate of return from the net cash flows expected from this investment.

_____ 4. This method of evaluating capital investment proposals uses present value concepts to compute the present value of the cash flows expected from a proposal.

_____ 5. A series of equal cash flows at fixed intervals.

_____ 6. These methods of evaluating capital investment proposals take into consideration the fact that money has a time value.

_____ 7. The process by which management allocates available investment funds among competing capital investment proposals.

_____ 8. The expected time that will pass between the date of a capital investment and the complete recovery in cash (or equivalent) of the amount invested.

_____ 9. The sum of the present values of a series of equal cash flows received at fixed intervals.

_____ 10. The budget which is prepared after capital investment expenditures for a period have been approved.

_____ 11. The concept that an amount of money invested today will earn income.

_____ 12. A period when prices in general are rising and the purchasing power of money is declining.

_____ 13. An index computed by dividing the total present value of the net cash flow to be received from a proposed capital investment by the amount to be invested.

TRUE / FALSE

Instructions: Indicate whether each of the following statements is true or false by placing a check mark in the appropriate column.

	True	False
1. The two common present value methods used in evaluating capital investment proposals are (1) the net present value method and (2) the internal rate of return method.		
2. Two methods of evaluating capital investment proposals that ignore present value are (1) the average rate of return method and (2) the cash payback period method.		
3. The expected time that will pass between the date of capital investment and the complete recovery of cash (or equivalent) of the amount invested is called the present value period.		
4. The methods of evaluating capital investment proposals that ignore present value are especially useful in evaluating capital investments that have relatively long useful lives.		
5. The internal rate of return method, sometimes referred to as the time-adjusted rate of return method, uses present value concepts to compute the present value of the cash flows expected from a proposal.		
6. The excess of cash flowing in from revenue over the cash flowing out for expenses is termed net cash flow.		
7. The net present value method, sometimes called the internal rate of return or time-adjusted rate of return method, uses present value concepts to compute the rate of return from the net cash flows expected from the capital investment proposals.		
8. The present value index is computed by dividing the amount to be invested by the total present value of the net cash flow.		
9. The present value factor for an annuity of $1 is computed by dividing the annual net cash flow by the amount to be invested.		
10. Proposals that are funded in the capital rationing process are included in the capital expenditures budget to aid the planning and financing of operations.		

	True	False
11. The methods of evaluating capital investment proposals that ignore present value are often useful in evaluating capital investment proposals that have relatively long useful lives.	_____	_____
12. One advantage of the average rate of return method is that it includes the amount of income earned over the entire life of the proposal.	_____	_____
13. One disadvantage of the cash payback method is that it includes the expected profitability of a proposal.	_____	_____
14. The main advantage of the internal rate of return method is that the present values of the net cash flows over the entire useful life of the proposal are considered.	_____	_____

MULTIPLE CHOICE

Instructions: Circle the best answer for each of the following questions.

1. Which of the following methods of evaluating capital investment proposals ignores present value concepts?

a. average rate of return method
b. discounted cash flow method
c. discounted internal rate of return method
d. none of the above

2. The method of evaluating capital investment proposals which determines the total present value of cash flows expected from investment proposals and compares these values with the amounts to be invested is:

a. average rate of return method
b. cash payback method
c. discounted internal rate of return method
d. discounted cash flow method

3. The method of evaluating capital investment proposals which uses present value concepts to compute the rate of return from the net cash flows expected from the proposals is:

a. average rate of return method
b. cash payback method
c. discounted internal rate of return method
d. discounted cash flow method

4. Jones Inc. is considering the purchase of a machine that costs $360,000. The machine is expected to have a useful life of 10 years, with no salvage value, and is expected to yield an annual net cash flow of $120,000 and an annual operating income of $60,000. What is the estimated cash payback period for the machine?
   a 2 years
   b. 3 years
   c. 5 years
   d. 6 years

5. Management is considering an $800,000 investment in a project with a 6-year life and no residual value. If the total income from the project is expected to be $600,000 and recognition is given to the effect of straight-line depreciation on the investment, the average rate of return is:
   a. 12.5%
   b. 25%
   c. 32%
   d. 44%

6. Which of the following is a qualitative consideration that may impact upon capital investment analysis?
   a. employee morale
   b. expected net cash inflows
   c. amounts of cash to be invested
   d. timing of cash inflows

7. Genko Company has purchased a machine for $145,000. The machine is expected to generate a positive annual net cash flow of $50,000 for four consecutive years. What is the present value index assuming money is worth 10%?
   a. 0.942
   b. 0.915
   c. 1.093
   d. 1.379

EXERCISE 26-1

Daily Inc. is considering the acquisition of a newly developed machine at a cost of $620,000. This machine is expected to have a useful life of 5 years and no residual value. Use of the new machine is expected to yield total income of $240,000 during the 5 years of its useful life and to provide an average annual net cash flow of $200,000. The minimum rate of return desired by Daily is 12%. The maximum cash payback period desired by Daily is 3 years.

Instructions: Using the information given, make the analyses indicated and write your answers in the spaces provided.

(1) What average rate of return (based on the average investment) can Daily expect to achieve during the useful life of this machine? . . . . . _____%

(2) What is the expected cash payback period for this proposed expenditure? . . . . . _____years

(3) Based on the analysis of average rate of return, should the management of Daily acquire the new machine? . . . . . yes____ no_____

(4) Based on the expected cash payback period, should management acquire the new machine? . . . . . yes____ no_____

EXERCISE 26-2

Crusty Corp. is evaluating two capital investment proposals, each requiring an investment of $250,000 and each with a six-year life and expected total net cash flows of $360,000.

Proposal 1 is expected to provide equal annual net cash flows of $60,000. Proposal 2 is expected to have the following unequal net cash flows:

Year 1	$100,000	Year 4	$45,000
Year 2	80,000	Year 5	45,000
Year 3	70,000	Year 6	20,000

Instructions: Determine the cash payback period for each proposal.

Proposal 1:

Proposal 2:

PROBLEM 26-1
Instructions

(1) Complete the following table using the net present value method to evaluate capital investment in new equipment.

Year	Present Value of 1 at 12%	Net Cash Flow	Present Value of Net Cash Flow
1	.893	$ 80,000	$
2	.797	60,000	
3	.712	60,000	
4	.636	60,000	
5	.567	60,000	
Total		$ 320,000	$
Amount to be invested in equipment			180,000
Excess of present value over amount to be invested			$

(2) Compute the present value index for the new equipment. (Round to two decimal places.)

(3) Based on the net present value method, should management acquire the new machine? ..... yes____ no____

PROBLEM 26-2

Preston Co. is evaluating two projects which have different useful lives but which have an equal investment requirement of $180,000. The estimated net cash flows from each project are as follows:

Year	Project 1	Project 2
1	$55,000	$55,000
2	50,000	55,000
3	45,000	55,000
4	40,000	55,000
5	40,000	55,000
6	30,000	
7	15,000	

Preston Co. has selected a rate of 10% for purposes of net present value analysis. Preston also estimates that there will be no residual value at the end of each project's useful life, but at the end of the fifth year, Project 1's residual value would be $60,000.

Instructions

(1) For each project, compute the net present value.

(2) For each project, compute the net present value, assuming that Project 1 is adjusted to a five-year life for purposes of analysis.

(3) Determine which of the two projects is more attractive based upon your findings in (2) above.

Solutions

CHAPTER 17

MATCHING

1.	M	9.	O
2.	G	10.	V
3.	I	11.	Q
4.	C	12.	A
5.	S	13.	N
6.	R	14.	T
7.	B	15.	K
8.	P	16.	U

TRUE / FALSE

1.	F	10.	F
2.	T	11.	F
3.	F	12.	F
4.	T	13.	T
5.	F	14.	T
6.	F	15.	T
7.	F	16.	T
8.	T	17.	T
9.	F	18.	F

MULTIPLE CHOICE

1.	d	5.	c
2.	c	6.	b
3.	d	7.	b
4.	a	8.	a

EXERCISE 17-1

	Product Cost			Period Cost	
Cost	Direct Materials Cost	Direct Labour Cost	Factory Overhead Cost	Spelling Expense	Administrative Expense
1.					X
2.			X		
3.	X				
4.				X	
5.			X		
6.		X			
7.				X	
8.					X
9.			X		
10.		X			
11.			X		
12.					X
13.	X				
14.			X		
15.	X				
16.			X		
17.				X	
18.					X
19.			X		
20.					X
21.				X	
22.		X			
23.	X				
24.					X
25.			X		
26.	X				

EXERCISE 17–2

	Direct Cost	Indirect Cost
1.		X
2.	X	
3.		X
4.	X	
5.	X	
6.	X	
7.		X
8.	X	
9.	X	
10.	X	
11.		X
12.	X	
13.		X
14.	X	
15.		X
16.		X
17.	X	
18.	X	
19.		X
20.	X	

PROBLEM 17–1

(a)	Cost of materials used in production:	
	Direct materials inventory, April 1	$ 114,000
	+Direct materials purchases	700,000
	–Direct materials inventory, March 31	(76,000)
	Cost of materials used	$ 738,000
(b)	Total manufacturing costs:	
	Cost of materials used (see (a))	$ 738,000
	+Direct labour costs	270,000
	–Overhead costs	198,000
	Total manufacturing costs	$1,206,000
(c)	Cost of goods manufactured:	
	Work in process, April 1	$ 84,500
	+Total manufacturing costs (see (b))	1,206,000
	–Work in process, March 31	(46,000)
	Cost of goods manufactured	$1,244,500
(d)	Cost of goods sold:	
	Finished goods inventory, April 1	$ 205,000
	+Cost of goods manufactured (see (c))	1,244,500
	–Finished goods inventory, March 31	(106,000)
	Cost of goods sold	$1,343,500

PROBLEM 17–2

Lyons Inc.
Income Statement
For Year Ended March 31, 20—

Sales		$1,750,000
Cost of goods sold		1,343,500
Gross profit		$ 406,500
Operating expenses:		
Selling expenses	$120,000	
Administrative expenses	97,000	
Total operating expenses		217,000
Net income		$ 189,500

CHAPTER 18

MATCHING

1. N	8. P		
2. D	9. Q		
3. I	10. B		
4. K	11. J		
5. R	12. G		
6. A	13. H		
7. M	14. E		

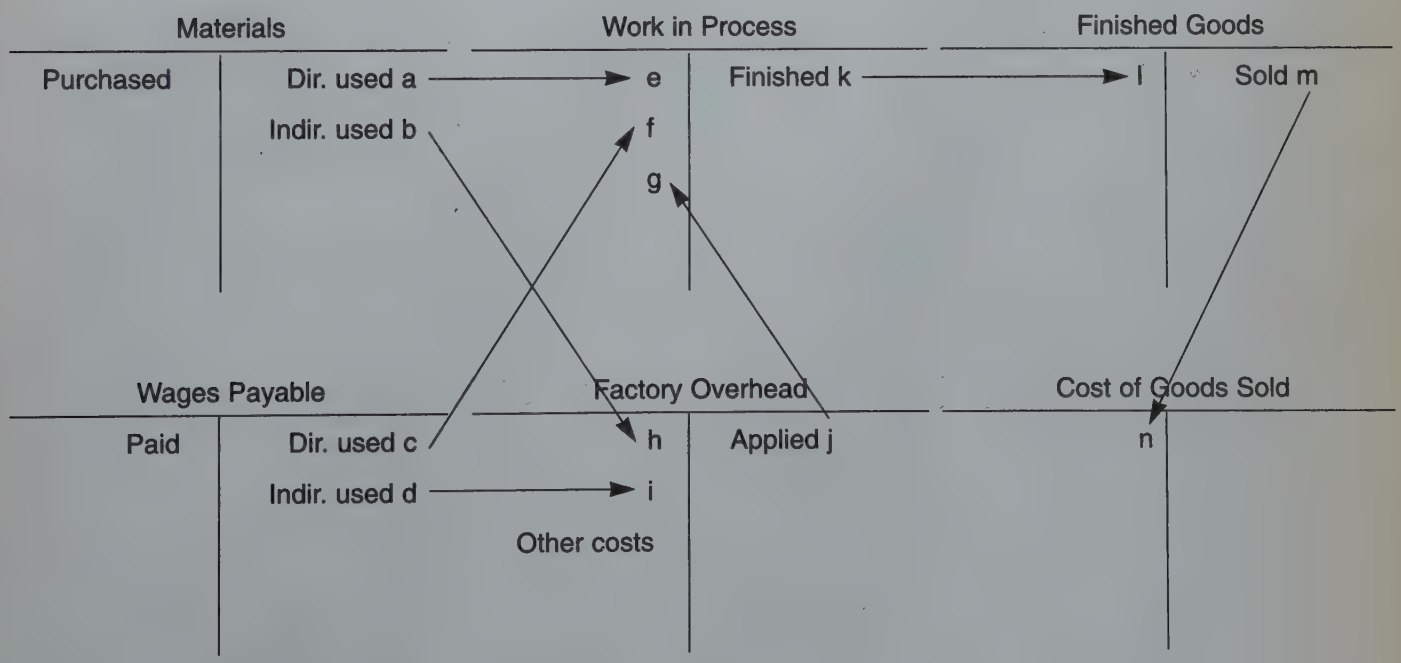
TRUE / FALSE

1. T	8. F		
2. F	9. T		
3. F	10. F		
4. F	11. T		
5. T	12. F		
6. T	13. F		
7. T	14. T		

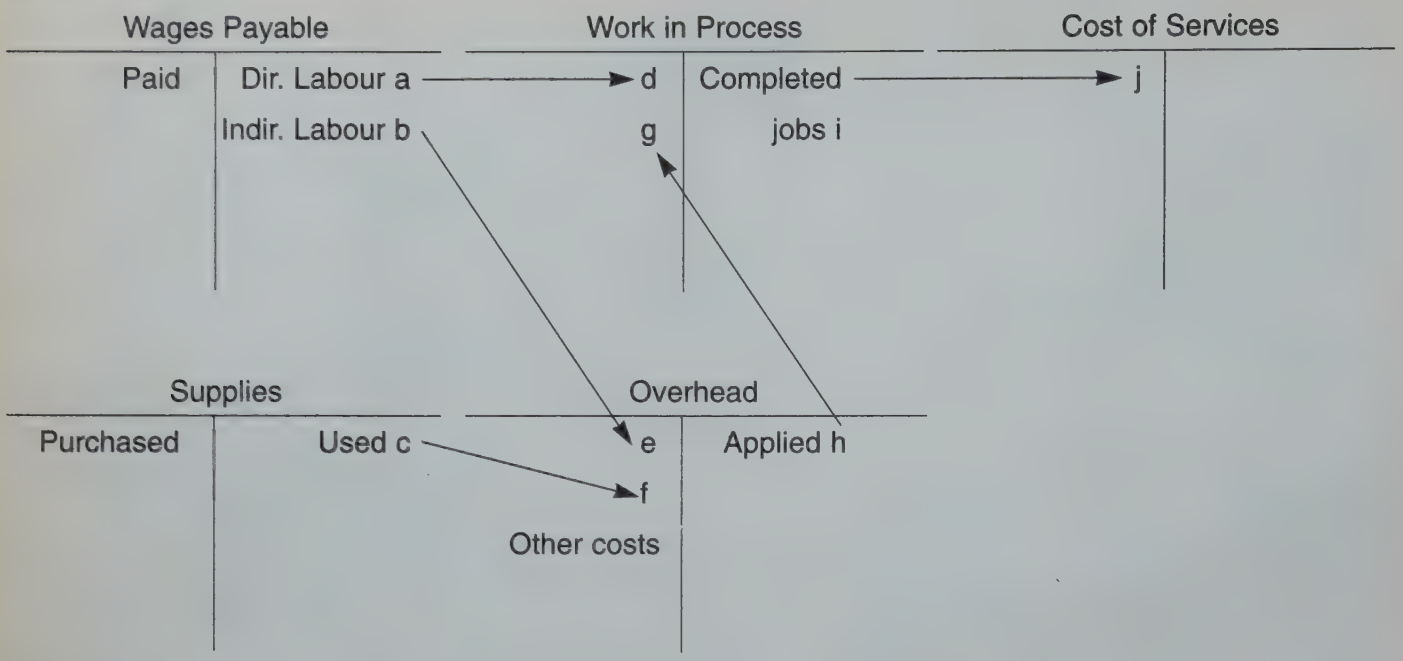
MULTIPLE CHOICE

1. b	5. b		
2. c	6. a		
3. b	7. c		
4. d			

EXERCISE 18–1



EXERCISE 18-2



EXERCISE 18–3

(a) $3.25 per machine hour ($65,000 / 20,000 hours)

(b) 42% of direct labour cost ($243,600 / $580,000)

(c)

Work in Process — Factory 1	5,850	
Factor Overhead — Factory 1		$5,850
($3.25 × 1,800)		
Work in Process — Factory 2	20,370	
Factory Overhead — Factory 2		$20,370
(42% × $48,500)		

(d) Factory 1 — $200 debit (underapplied)
Factory 2 — $270 credit (overapplied)

PROBLEM 18–1

(1)	Materials	60,000	
	Prepaid Expenses	5,300	
	Accounts Payable		65,300
(2)	Work in Process	23,200	
	Factory Overhead	1,200	
	Materials		24,400
(3)	Work in Process	35,900	
	Factory Overhead	2,700	
	Wages payable		38,600
(4)	Factory Overhead	12,200	
	Selling Expenses	21,950	
	Administrative Expenses	15,300	
	Accounts Payable		49,450
(5)	Factory Overhead	5,000	
	Selling Expenses	800	
	Administrative Expenses	600	
	Prepaid Expenses		6,400
(6)	Work in Process	25,130	
	Factory Overhead		25,130
(7)	Finished Goods	53,000	
	Work in Process		53,000
(8)	Accounts Receivable	160,000	
	Sales		160,000
	Costs of Goods Sold	110,000	
	Finished Goods		110,000

PROBLEM 18–2

Cash

Balance	135,400	(1)	78,000
		(4)	12,500

Finished Goods

Balance	50,800		
(6)	164,000		

Work in Process

Balance	33,800	(6)	164,000
(2)	56,000		
(3)	70,000		
(5)	24,000		

Materials

Balance	18,000	(2)	58,400
(1)	78,000		

Factory Overhead

Balance	3,000	(5)	24,000
(2)	2,400		
(3)	5,000		
(4)	12,500		

Wages Payable

		(3)	75,000

CHAPTER 19

MATCHING

1. K	7. O		
2. A	8. F		
3. E	9. L		
4. C	10. I		
5. B	11. M		
6. H	12. J		
	13. N		

TRUE / FALSE

1. T	7. T		
2. T	8. F		
3. T	9. F		
4. F	10. F		
5. T	11. F		
6. F	12. F		
	13. F		

MULTIPLE CHOICE

1. c	4. b		
2. d	5. b		
3. a	6. c		

EXERCISE 19–1

(a) Purchases
(b) Direct materials
(d) Direct labour
(e) Factory overhead applied
(f) Costs transferred out / Costs transferred in
(g) Direct labour
(h) Factory overhead applied
(i) Costs transferred out /Costs transferred in
(j) Cost of goods sold

EXERCISE 19–2

Units	Total Whole Units	% Material to Be Completed in April	% Conversion to Be Completed in April	(1) Equivalent Units for Materials	(2) Equivalent Units for Conversion
Beginning Inventory	12,000	0%	70%	0	8,400
Started and Completed (66,000 - 12,000)	54,000	100%	100%	54,000	54,000
Transferred Out	66,000			54,000	62,400
Ending Inventory	8,000	100%	20%	8,000	1,600
Total Equivalent Units for Account For				62,000	64,000

Costs	(3) Direct Materials	(4) Conversion Costs	Total
Total Costs Incurred this Period	$148,800	$326,400	
Cost per Equivalent Unit	$2.40 ($148,800 ÷ 62,000)	$5.10 ($326,400 ÷ 64,000)	
Beginning Inventory—Balance			$32,600
Beginning Inventory—Completed (equiv. units x rate)	0	$42,840	42,840
Started and Completed (equiv. units x rate)	$129,600	275,400	405,000
Transferred Out (6)			$480,440
Ending Inventory (equiv. units x rate) (5)	$ 19,200	$ 8,160	27,360
Total Costs Charged to Department			$507,800

PROBLEM 19–1

(1)	Material	210,000	
	Accounts Payable		210,000
(2)	Factory Overhead - Department 10	2,100	
	Factory Overhead - Department 20	600	
	Work in Process - Department 10	18,000	
	Work in Process - Department 20	24,000	
	Materials		44,700
(3)	Factory Overhead - Department 10	2,700	
	Factory Overhead - Department 20	2,700	
	Work in Process - Department 10	25,000	
	Work in Process - Department 20	20,000	
	Wages Payable		50,400
(4)	Factory Overhead - Department 10	1,500	
	Factory Overhead - Department 20	2,250	
	Accounts Payable		3,750
(5)	Factory Overhead - Department 10	4,200	
	Factory Overhead - Department 20	3,150	
	Accumulated Amortization - Plant Assets		7,350
(6)	Work in Process - Department 10	25,500	
	Work in Process - Department 20	15,000	
	Factory Overhead - Department 10		25,500
	Factory Overhead - Department 20		15,000
(7)	Work in Process - Department 20	68,500	
	Work in Process - Department 10		68,500
(8)	Finished goods	115,000	
	Work in process - Department 20		115,000
(9)	Cost of Goods Sold	122,000	
	Finished Goods		122,000
	Accounts Receivable	160,000	
	Sales		160,000

PROBLEM 19–2

Ivy Inc.
Cost of Production Reprot—Polishing Department
For the Month Ended March 31, 19—

UNITS	Whole Units	Equivalent Units: Direct Materials	Equivalent Units: Conversion
Units charged to production:			
Inventory in process, March 1	5,000		
Received from Cutting	21,000		
Total units accounted for by Polishing Dept.	26,000		
Units to be assigned costs:			
Inventory in process, March 1 (30% completed)	5,000	0	3,500
Started and completed in March	15,000	15,000	15,000
Transferred to finished goods in March	20,000	15,000	18,500
Inventory in process, March 31 (60% completed)	6,000	6,000	3,600
Total units to be assigned cost	26,000	21,000	22,100

COSTS	Costs: Whole Units	Costs: Direct Materials	Costs: Conversion
Unit Costs:			
Total cost for March in Polishing	$105,000	$296,140	
Total equivalent units (from above)	÷ 21,000	÷ 22,100	
Cost per equivalent unit	$ 5.00	$ 13.40	
Costs charged to production:			
Inventory in process, March 1			$37,025
Costs incurred in March			401,140
Total costs accounted for by Polishing Dept.			$438,165
Costs allocated to completed and partially completed units:			
Inventory in process, March 1 – balance			$37,025
To complete inventory in process, March 1	0	$46,900 (a)	46,900
Started and completed in March	75,000 (b)	201,000 (c)	276,000
Transferred to finished goods in March			$359,925
Inventory in process, March 31	30,000 (d)	48,240 (e)	78,240
Total costs assigned by Polishing Dept.			$438,165

(a) 3,500 × $13.40 = $46,900
(b) 15,000 × $5.00 = $75,000
(c) 15,000 × $13.40 = $201,000
(d) 6,000 × $5.00 = $30,000
(e) 3,600 × $13.40 = $48,240

CHAPTER 20

MATCHING

1.	E	9.	M
2.	R	10.	O
3.	H	11.	J
4.	N	12.	D
5.	I	13.	L
6.	F	14.	A
7.	B	15.	K
8.	G	16.	P

TRUE / FALSE

1.	T	9.	T
2.	T	10.	T
3.	T	11.	F
4.	F	12.	F
5.	T	13.	F
6.	F	14.	F
7.	T	15.	T
8.	T		

MULTIPLE CHOICE

1.	d	5.	b
2.	c	6.	a
3.	b	7.	a
4.	c	8.	c

EXERCISE 20–1

(1) Difference in total costs: $300,000 ($550,000 - $250,000)
Difference in total units of production:
30,000 units (50,000 units - 20,000 units)

(2) Variable cost per unit: $10 ($300,000 / 30,000 units)
Fixed cost estimated at highest level of production:
Total Cost = Total Variable Cost + Fixed Cost
$550,000 = ($10 × 50,000 units) + Fixed Cost
$550,000 = $500,000 + Fixed Cost
Fixed Cost = $50,000
or
Fixed Cost estimated at lowest level of production:
Total Cost = Total Variable Cost + Fixed Cost
$250,000 = ($10 × 20,000 units) + Fixed Cost
$250,000 = $200,000 + Fixed Cost
Fixed Cost = $50,000

(3) Total Cost = Total Variable Cost + Fixed Cost
Total Cost = ($10 × 80,000 units) + $50,000
Total Cost = $800,000 + $50,000
Total Cost = $850,000

EXERCISE 20–2

Cost-Volume-Profit Chart
a. fixed costs
b. break-even point
c. operating profit area
d. total sales
e. operating loss area
f. total costs

EXERCISE 20–3

(1) ($2,000,000 - $1,700,000) / $2,000,000 = 15%

(2) ($150,000 - $100,000) / $150,000 = 33%

(3) $300,000 / $175,000 = 1.71

(4)

Sales	$700,000
Variable costs	300,000
Contribution margin	$ 400,000

$400,000 / $200,000 = 2

PROBLEM 20–1

(1) 700,000 / 50 = 14,000 units
(2) 710,000 / 50 = 14,200 units
(3) 700,000 / 49 = 14,286 units
(4) 700,000 / 52 = 13,462 units
(5) (700,000 + 300,000) / 50 = 20,000 units

PROBLEM 20–2

(1) ($180 × .80) + ($280 × .20) = $200 unit selling price of E
($140 × .80) + ($190 × .20) = $150 unit variable cost of E
($40 × .80) + ($90 × .20) = $50 unit contribution margin of E
Break-even point (units): $400,000 / $50 = 8,000 units
Sales necessary in dollars: 8,000 × $200 = $1,600,000

(2)	Product A	Product B	Total
Sales:			
6,400 units × $180	$1,152,000		$1,152,000
1,600 units × $280		$448,000	448,000
Total sales	$1,152,000	$448,000	$1,600,000
Variable costs:			
6,400 units × $140	896,000		896,000
1,600 units × $190		304,000	304,000
Total variable costs	$ 896,000	$304,000	$1,200,000
Contribution margin			400,000
Fixed costs			400,000
Operating profit			0

CHAPTER 21

MATCHING
1. E
2. C
3. A
4. D
5. F
6. B

TRUE / FALSE
1. F
2. T
3. F
4. F
5. T
6. F
7. T
8. F

MULTIPLE CHOICE
1. d
2. e
3. c
4. c
5. c
6. b
7. c
8. b

EXERCISE 21–1

Solution

A) $$\frac{\$50{,}000 + \$24{,}000 + \$90{,}000 + \$32{,}000 + \$42{,}000}{100{,}000 \text{ hours}} =$$

$$\frac{\$238{,}000}{100{,}000 \text{ hrs}} = \$2.38 \text{ per hour}$$

B) Chief's Knife – .8 × $2.38 = $1,904
Butcher Knife – 1.2 × $2.38 = $2.856

EXERCISE 21–2

	Dept. One	Dept. Two
	$55,000,000 / 1,000,000 machines	$250,000,000 / 5,000,000 lbr. hrs.
	$55.00 / machine hour	$50.00 / lbr. hour

A) Viking Software

500 × 55	=	$27,500
100 × 50	=	5,000
		$32,500

B) Byte-Me Software

250 × 55	=	$13,750
30 × 50	=	1,500
		$15,250

EXERCISE 21–3

1. Machining $\frac{\$276,000}{16,000 \text{ m hrs}}$ = $17.25/machine hour

   Finishing $\frac{\$480,000}{48,000 \text{ lbr hr}}$ = $10.00 / labour hour

2.

Economy –	.05 × $17.25	=	$ .863
	.08 × $10.00	=	.800
			$1.663
Midrange –	.10 × $17.25	=	$1.725
	.18 × 10.00	=	1.800
			$3.525
Deluxe –	.15 × $17.25	=	$2.588
	.25 × 10.00	=	2.500
			$5.088

EXERCISE 21–4

1. Casting $\frac{\$360,000}{90,000 \text{ m hrs}}$ = $4.00 / machine hour

   Assembly $\frac{\$300,000}{60,000 \text{ d lbr hrs}}$ = $5.00 / direct labour hour

   Inspection $\frac{\$33,000}{20,000 \text{ inspection}}$ = $1.65 / inspection

   Set Up $\frac{\$100,000}{40,000 \text{ setups}}$ = $2.50 / setup

   Materials Handling $\frac{\$60,000}{40,000 \text{ loads}}$ = $1.50/load

Product #1			
Casting	40,000 × $4.00	=	$160,000
Assembly	35,000 × $5.00	=	175,000
Inspection	10,000 × $1.65	=	16,500
Set Up	15,000 × $2.50	=	37,500
Materials Handling	20,000 × $1.50	=	30,000
			$419,000
Product #2			
Casting	50,000 × $4.00	=	$200,000
Assembly	25,000 × $5.00	=	125,000
Inspection	10,000 × $1.65	=	16,500
Set Up	25,000 × $2.50	=	62,500
Materials handling	20,000 × $1.50	=	30,000
			$434,000

PROBLEM 21–1

1. Assembly $\frac{\$455,000}{140,000 \text{ Units}} = \$3.25 / \text{unit}$

   Sanding $\frac{\$560,000}{320,000 \text{ Mach Hrs.}} = \$1.75 / \text{machine hour}$

   Painting $\frac{\$370,000}{200,000 \text{ lbr hrs.}} = \$1.85 / \text{labour hour}$

   Application Design $\frac{\$3,230,000}{380,000 \text{ lbr hrs}} = \$8.50 / \text{labour hour}$

   Inspection of Finished Product = $\frac{\$280,000}{140,000 \text{ units}} = \$2.00 / \text{unit}$

2. School Table

Assembly	40,000 × $3.25	=	$130,000
Sanding	120,000 × 1.75	=	210,000
Painting	50,000 × 1.85	=	925,000
Design	80,000 × 8.50	=	660,000
Inspection	40,000 × 2.00	=	80,000
			$2,005,000

Community Club Table

Assembly	100,000 × $3.25	=	$325,000
Assembly	200,000 × 1.75	=	350,000
Painting	150,000 × 1.85	=	277,500
Design	300,000 × 8.50	=	2,550,000
Inspection	100,000 × 2.00	=	200,000
			$3,702,500

PROBLEM 21-2

Solution

1.

A) $\frac{\$500{,}000 + \$1{,}800{,}000 + \$300{,}000 + \$600{,}000 + \$1{,}800{,}000}{6600 \text{ labour hours}}$

$= \$757.58$ per labour hour

B) $\frac{\$500{,}000 + \$1{,}800{,}000 + \$300{,}000 + \$600{,}000 + \$1{,}800{,}000}{8400 \text{ machine hours}}$

$= \$595.24$ per machine hour

2. *Labour Hour Allocation*

Widgets

Assembly	4,000
Finishing	450
	4,500 hours
	× 757.58
	$3,371,231

Gadgets

Assembly	2,000
Finishing	150
	2,150 hours
	× 757.58
	$1,628,797

B) Machine Hour Allocation

Widgets

Assembly	800
Finishing	4,000
	4,800 hrs
	× $595.24
	$2,857,152

Gadgets

Assembly	600
Finishing	3,000
	3,600
	× $595.24
	$2,142,864

PROBLEM 21–3 SOLUTION

1. Design $\frac{\$670,000}{13,400 \text{ hrs}} = \$50$ per design hour

   Set Up $\frac{50,000}{1250 \text{ hrs}} = \$40$ per set-up hour

   Production $\frac{\$2,255,500}{347,000 \text{ hrs}} = \$6.50$ per machine hour

   Inspection $\frac{\$6,625}{5,300 \text{ hrs}} = \$1.25$ per labour hour

   Transport $\frac{\$12,600}{280} = \$45$ per load shipped

2. Plastic Knives

Design	3050 × $50	=	$152,500
Set Up	500 × $40	=	20,000
Production	100,000 × $6.50	=	650,000
Inspection	1500 × $1.25	=	1,875
Transport	60 × $45	=	2,700
			$827,075

Plastic Forks

Design	5450 × $50	=	$272,500
Set Up	450 × $40	=	18,000
Production	115,000 × $6.50	=	747,500
Inspection	2,000 × $1.25	=	2,500
Transport	100 × $45	=	4,500
			$1,045,000

Plastic Spoons

Design	4900 × $50	=	$245,000
Set Up	500 × $40	=	20,000
Production	132,000 × $6.50	=	858,000
Inspection	1,800 × $1.25	=	2,250
Transport	120 × $45	=	5,400
			$1,130,650

3. Cost Per Case

Plastic Knives $= \frac{\$827,075}{300,000} = \$2.757$/case

Plastic Forks $= \frac{\$1,045,000}{450,000} = \$2.322$/case

Plastic Spoons $= \frac{\$1,130,650}{960,000} = \$1.178$/case

CHAPTER 22

MATCHING

1.	B	7.	C
2.	N	8.	M
3.	F	9.	D
4.	I	10.	K
5.	L	11.	E
6.	H	12.	G

TRUE / FALSE

1.	F	6.	F
2.	T	7.	T
3.	F	8.	F
4.	T	9.	F
5.	T	10.	T

MULTIPLE CHOICE

1.	c	4.	c
2.	a	5.	c
3.	d	6.	b

EXERCISE 22–1

Texier Inc.
Sales Budget
For the Month of May, 19—

Product and Area	Unit Sales Volume	Unit Selling Price	Total Total Sales
Product C:			
East area	60,000	$ 15	$9,000,00
West area	80,000	20	1,600,000
Total	140,000		$2,500,000
Product Q:			
East area	75,000	$8	$ 600,000
West area	50,000	10	500,000
Total	125,000		$1,100,000
Total revenue from sales			$3,600,000

Texier Inc.,
Production Budget
For the Month of May, 19—

	Units	
	Product C	Product Q
Sales	140,000	125,000
Plus desired inventory, May 31	28,000	25,000
Total	168,000	150,000
Less estimated inventory, May 1	8,000	21,000
Total production	160,000	129,000

EXERCISE 22–2

Nathalie Inc.
Factory Overhead Cost Budget
For the Month of January, 19—

Units of product	30,000	60,000	90,000
Variable cost:			
Indirect factory wages	$24,000	$48,000	$72,000
Indirect materials	13,500	27,000	40,500
Electric power	18,000	36,000	54,000
Total variable cost	$55,500	$111,000	$166,500
Fixec cost:			
Supervisory salaries	$30,000	$30,000	$30,000
Amortization of capital equipment	$18,000	18,000	18,000
Property taxes	12,000	12,000	12,000
Insurance	7,500	7,500	7,500
Electric power	4,500	4,500	4,500
Total fixed cost	$72,000	$72,000	$72,000
Total factory overhead cost	$127,500	$183,000	$238,500

PROBLEM 22–1

Amant Inc.
Cash Budget
For Two Month Ending April 30, 19—

	March	April
Estimated cash receipts from:		
Cash sales	$ 96,000	$ 80,000
Collections of accounts receivable	160,200	124,800
Total cash receipts	$256,200	$204,800
Estimated cash disbursements for:		
Merchandise costs	$130,000	$140,000
Operating expenses	34,000	28,000
Capital expenditures	—	125,000
Property taxes	5000	—
Total cash disbursements	$169,000	$293,000
Cash increase or (decrease)	$ 87,200	$(88,200)
Cash balance at beginning of month	24,000	111,200
Cash balance at end of month	$111,200	$ 23,000
Minimum cash balance	50,000	50,000
Excess or (deficiency)	$61,200	$(27,000)

PROBLEM 22–2

(1)

Production Budget	Product A	Product B
Sales	168,000	324,000
Plus: desired ending inventory	8,000	36,000
Less: estimated beginning inventory	(12,000)	(24,000)
Total production	164,000	336,000

(2)

Material Purchases Budget	Material X	Material Y	Material Z	Total
Pounds required for production				
Product A	98,400		196,800	
Product B	604,800	1,142,400		
Plus desired ending inventory	14,500	8,700	9,800	
Total	717,700	1,151,100	206,600	
Less: estimated beginning inventory	(16,000)	(5,600)	(12,400)	
Total pounds to be purchased	701,700	1,145,500	194,200	
Price per pound	× $0.40	× $0.50	× $0.60	
Total direct material purchases	$280,680	$572,750	$116,520	$969,950

(3)

Direct Labour Cost Budget	Department 1	Department 2	
Product A hours	32,800	24,600	
Product B hours	16,800	33,600	
Total hours	49,600	58,200	
Hourly departmental rate	× $14.00	× $18.00	
Total direct labour cost	$694,400	$1,047,600	$1,742,000

CHAPTER 23

MATCHING

1. H	8. I		
2. E	9. N		
3. D	10. L		
4. M	11. C		
5. F	12. G		
6. O	13. B		
7. P			

TRUE / FALSE

1. T	6. F		
2. F	7. F		
3. T	8. T		
4. F	9. F		
5. T	10 T		

MULTIPLE CHOICE

1. a	4. d		
2. c	5. b		
3. b			

EXERCISE 23–1

(1) Price variance:

Actual price	$1.82 per pound	
Standard price	1.80 per pound	
Variance — unfavourable	$.02 per pound	
	× actual quantity, 77,000	$1,540

Quantity variance:

Actual quantity	77,.000 pounds	
Standard quantity	75,000 pounds	
Variance — unfavourable	2,000 pounds	
	× standard price, $1.80	3,600
Total direct materials cost variance — unfavourable		$5,140

(2) Rate variance:

Actual rate	$19.75 per hour	
Standard rate	20.00 per hour	
Variance — favourble	$ –.25 per hour	
	× actual time, 42,500 hours	$(10,625)

Time variance:

Actual time	42,500 hours	
Standard time	42,500 hours	
Variance — unfavourable	500 hours	
	× standard rate, $20.00	10,000
Total direct labour cost variance — favourable		$ (625)

EXERCISE 23–2

Controllable variance

Actual variable factory overhead	$ 153,500	
Budgeted variable factory overhead for 30,000 hours	150,000	
Variance — unfavourable		$3,500

Volume variance:

100% of normal capacity	40,000 hours	
Standard for amount produced	30,000 hours	
Productive capacity not used	10,000 hours	
Standard fixed factory overhead rate	× $3	
Variance — unfavourable		30,000
Total factory overhead cost variance — unfavourable		$33,500

EXERCISE 23–3

Nathalie Inc.
Budget Performance Report — Factory Overhead Cost
For Month Ended January 31, 19—

	Budget	Actual	Unfavourable	Favourable
Variable cost:				
Indirect factory wages	$48,000	$50,500	$2,500	
Indirect materials	27,000	27,600	600	
Electric power	36,000	35,000		$1,000
Total variable cost	$111,000	$113,100		
Fixed cost:				
Supervisory salaries	$ 30,000	$ 30,000		
Amortization of capital equipment	18,000	18,000		
Property taxes	12,000	12,000		
Insurance	7,500	7,500		
Electric power	4,500	4,500		
Total fixed cost	72,000	72,000		
Total factory overhead cost	$183,000	$185,100	$3,100	$1,000

EXERCISE 23–4

(1)

30	employees
× 40	hours per week
1,200	total hours worked
× $16	labour rate per hour
$19,200	IRS labour cost

(2) Flexible budget:

No. of traditional paper returns processed	1,300 × 45 min.	=	58,500 min.
No. of electronic returns processed	225 × 8 min.	=	1,800 min.
			60,300 min.

60,300 / 60 = 1,005 hours flexible budget.

(3) Time variance

Actual time	1,005 hours
Standard time	1,200 hours
Variance - favourable	(195) hours × $16 rate = $(3,120)

PROBLEM 23–1

(1) Direct Materials Cost Variances

			Variance	
Price variance:				
Actual price	$6.20	per lb.		
Standard price	6.00			
Variance	$ .20	per lb. × actual quan., 250,000 lbs.	$50,000	U
Quantity variance:				
Actual quantity	250,000	lbs.		
Standard quantity	255,000	lbs.		
Variance	–5,000	lbs. × standard price, $6	30,000	F
Total direct materials cost variance			$20,000	U

(2) Direct Labour Cost Variances

Rate variance:				
Actual rate	$14.60	per hr.		
Standard rate	15.00	per hr.		
Variance	$ - .40	per hr. × actual time, 77,400 hrs.	$30,960	F
Time variance:				
Actual time	77,400	hrs.		
Standard time	76,500	hrs.		
Variance	900	hrs. × standard rate, $15	13,500	U
Total direct labour cost variance			$17,460	F

(3) Factory Overhead Cost Variances

Volume variance:			
100% (hours) of normal capacity	90,000		
Standard for product produced (hours)	76,500		
Productive capacity not used (hours)	13,500		
Standard fixed factory overhead cost rate	× $1.50		
Variance		$20,250	U
Controllable variance:			
Actual variable factory overhead cost incurred	$295,000		
Budgeted variable factory overhead for standard product produced	288,000		
Variance		7,000	U
Total factory overhead cost variance		$27,250	U

PROBLEM 23–2

Piazza Company, Inc.
Income Statement
For the Month Ended January 31, 19—

	Favorable	Unfavorable	
Sales			$995,000
Cost of goods sol—at standard			812,000
Gross profit—at standard			$183,000
Less variances from standard cost:			
Direct materials price		$ 500	
Direct materials quantity		1,500	
Labour rate		1,200	
Labour time	$3,000		
Factory overhead—controllable	4,000		
Factory overhead volume		10,000	6,200
			$176,800
Operating expenses:			
Selling expenses		$68,000	
Administrative expenses		42,000	110,000
Income before income tax			$ 66,800

CHAPTER 24

MATCHING

1. Q	9. O		
2. E	10. I		
3. C	11. R		
4. G	12. A		
5. L	13. K		
6. H	14. D		
7. N	15. P		
8. M			

TRUE / FALSE

1. T	9. F		
2. F	10. F		
3. T	11. T		
4. F	12. F		
5. T	13. F		
6. F	14. T		
7. T	15. T		
8. T	16. F		

MULTIPLE CHOICE

1. a	5. d
2. b	6. d
3. c	7. c
4. d	

EXERCISE 24-1

(1) (a) $280,000
(b) $120,000
(c) $520,000
(d) $135,000

(2) Division M: 16% ($120,000/$750,000)
Division N: 22% ($110,000/$500,000)

(3) Division M

(4) Division N

EXERCISE 24-2

(1) Division M:

Controllable operating income	$120,000
Minimum income ($750,000 × 12%)	90,000
Residual income	$ 30,000

Division N:

Controllable operating income	$110,000
Minimum income ($500,000 × 12%)	60,000
Residual income	$50,000

(2) Division N

EXERCISE 24–3

(a) 1.6
(b) 12.5%
(c) 18.9%
(d) 18%
(e) 1.5

PROBLEM 24–1

Budget Performance Report - Supervisor
Department F, Plant 7
For Month Ended July 31, 19—

	Budget	Actual	Over	Under
Factory wages	$65,000	$ 73,600	$8,600	
Materials	39,500	37,700		$1,800
Supervisory salaries	15,000	15,000		
Power and light	8,900	9,600	700	
Amortization of capital equipment	7,500	7,500		
Maintenance	4,300	3,900		400
Insurance and property taxes	2,000	2,000		
	$142,200	$149,300	$9,300	$2,200

PROBLEM 24–2

Firefly Co.
Income Statement - Divisions J and K
For Year Ended May 31, 19—

	Division J	Division K	Total
Net sales	$280,000	$420,000	$700,000
Cost of goods sold	122,500	227,500	350,000
Gross profit	$157,500	$192,500	$350,000
Direct charged expenses:			
Payroll accounting	$ 20,000	$ 30,000	$ 50,000
Purchasing	44,000	33,000	77,000
Brochure advertising	31,250	12,500	43,750
Total direct service department expenses	$ 95,250	$ 75,500	$170,750
Controllable operating income	$ 62,250	$117,000	$179,250
Indirect allocated expenses			
Sales	$ 48,000	$ 72, 000	$120,000
Corporate administration	10,900	16,350	27,250
	$ 58,900	$ 88,350	$147,250
Division income	$ 3,350	$ 28,650	$32,000
Other expense:			
Interest expense			14,000
Income before income tax			$ 18,000
Income tax			8,000
Net income			$ 10,000

Supporting Schedules Direct Charges	Number of payroll checks	Number of requisitions	Number of brochure pages	
Division J	400	2,000	500	
Division K	600	1,500	200	
Corporate	200	500	100	
Total	1,200	4,000	800	
Relative percentages (rounded)				
Division J	33.33%	50.00%	62.50%	
Division K	50,00%	37.50%	25.00%	
Corporate	16.67%	12.50%	12.50%	
Corporate service department cost	$60,000	$88,000	$50,000	Total Corporate Administration Costs
Percentages multiplied by service department cost				
Division J	20,000	44,000	31,250	
Division K	30,000	33,000	12,500	
Corporate	10,000	11,000	6,250	$27,250

Corporate allocations:

Sales percentage	Sales	Relative %
Division J	$280,000	40%
Division K	420,000	60%
Total	$700,000	

	Sales	Administration
Amount to be allocated	$120,000	$27,250

Amount allocated	Sales	Administration
Division J (amounts × rel. %)	$48,000	$10,900
Division K	$72,000	$16,350

PROBLEM 24–3

(1) (a) no effect
(b) no effect

(2) (a) increase by $30,000
(b) increase by $50,000

(3) (a) increase by $100,000
(b) decrease by $20,000

CHAPTER 25

MATCHING

1. D	8. J		
2. E	9. O		
3. F	10. A		
4. I	11. L		
5. K	12. B		
6. H	13. M		
7. N			

TRUE / FALSE

1. T	7. T		
2. F	8. T		
3. F	9. F		
4. F	10. T		
5. F	11. T		
6. F	12. F		

MULTIPLE CHOICE

1. c	5. d		
2. a	6. d		
3. b	7. c		
4. b	8. b		

EXERCISE 25–1

Differential revenue from alternatives:		
Revenue from lease	$20,000	
Revenue from sale	18,000	
Differential revenue from lease		$2,000
Differential cost of alternatives:		
License expenses during lease	$ 600	
Repainting expense on sale	1,200	
Differential cost of leasing		(600)
Net differential income (loss) from lease alt.		$2,600

EXERCISE 25–2

Purchase price of braces		$14.00
Differential cost to manufacture braces:		
Direct materials	$ 6.75	
Direct labor	5.10	
Variable factory overhead	.80	12.65
Cost savings (increase) from mfg. braces		$ 1.35

EXERCISE 25–3

Differential revenue from sales of rocking chairs:		
Revenue from sales		$350,000
Differential cost of sales of rocking chairs:		
Variable cost of goods sold	$180,000	
Variable operating expenses	75,000	255,000
Diff. income (loss) from sales of rocking chairs		$ 95,000

The rocking chairs section probably should be continued.

EXERCISE 25–4

Annual variable costs - present machine	$ 65,000	
Annual variable costs - new machine	30,000	
Annual differential decrease (increase) in variable costs	$ 35,000	
Number of years applicable	7	
Total differential decrease (increase) in variable costs	$245,000	
Proceeds from sale of present machine	83,000	$328,000
Cost of new machine		370,000
Net differential decrease (increase) in cost, 7-year total		$(42,000)
Annual net diff. decrease (increase) in cost - new machine		$ (6,000)

PROBLEM 25–1

(1) $60,000 ($500,000 × 12%)

(2) (a) Total costs and expenses:

Variable ($5 × 50,000 units)	$250,000
Fixed ($35,000 + $15,000)	50,000
Total	$300,000

Cost amount per unit: $300,000 / 50,000 units = $6

(b) Markup Percentage = Desired Profit/Total Costs and Expenses
Markup Percentage = $60,000 / $300,000
Markup Percentage = 20%

(c)

Cost amount per unit	$6.00
Markup ($6 × 20%)	1.20
Selling price	$7.20

PROBLEM 25–2

(1)

Total manufacturing costs:	
Variable ($4 × 50,000 units)	$200,000
Fixed factory overhead	35,000
Total	$235,000

Cost amount per unit: $235,000 / 50,000 units = $4.70

(2) Markup Percentage = (Desired Profit + Total Selling and Administrative Expenses) / Total Manufacturing Costs
= [$60,000 + $15,000 + ($1 × 50,000 units)] / 235,000
= $125,000 / $235,000
= 53.2%

(3)

Cost amount per unit	$ 4.70
Markup ($4.70 × 53./2%)	2.50
Selling price	$ 7.20

PROBLEM 25–3

(1) Total variable costs and expenses: $5 × 50,000 units = $250,000
Cost amount per unit: $250,000 / 50,000 units = $5

(2) Markup Percentage = Desired Profit + Total Fixed Costs / Total Variable Costs
= $60,000 + $35,000 + $15,000] / $250,000
= $110,000 / $250,000
= 44%

(3)

Cost amount per unit	$5.00
Markup ($5 × 44%)	2.20
Selling price	$7.20

PROBLEM 25–4

First, determine the contribution margin per bottleneck hour for each product.

	Product D	Product E	Product F
Sales price per variable unit	$750	$600	$400
Variable cost per unit	300	350	200
Contribution margin per unit	$450	$250	$200
Furnace hours per unit	15	10	8
Contribution margin per furnace hour (CM ÷ furnace hours)	$30.00	$25.00	$25.00

Product D is more profitable in per furnace hour terms than either Products E or F. Products E and F would need to increase prices enough to make their contribution margin per furnace hour equal to $30.

Product E:

$$(X - \$350) / 10 \text{ furnace hours} = \$30$$
$$X - \$350 = \$300$$
$$X = \$650$$

Product F:

$$(X - \$200) / 8 \text{ furnace hours} = \$30$$
$$X - \$200 = \$240$$
$$X = \$440$$

CHAPTER 26

MATCHING

1.	B	8.	H
2.	E	9.	O
3.	K	10.	D
4.	L	11.	R
5.	A	12.	J
6.	P	13.	N
7.	F		

TRUE / FALSE

1.	T	8.	F
2.	T	9.	F
3.	F	10.	T
4.	F	11.	F
5.	F	12.	T
6.	T	13.	F
7.	F	14.	T

MULTIPLE CHOICE

1.	a	5.	b
2.	d	6.	a
3.	c	7.	c
4.	b		

EXERCISE 26–1

(1) $48,000 / $310,000 = 15.48%

(2) $620,000 / $200,000 = 3.1 years

(3) Yes. The proposal meets the minimum rate of return desired.

(4) No. The proposal does not meet the minimum cash payback period desired.

EXERCISE 26–2

Proposal 1: $250,000 / $60,000 = 4.17 years

Proposal 2:

Year	Net Cash Flow	Cumulative Net Cash Flow
1	$100,000	$100,000
2	80,000	180,000
3	70,000	250,000
4	45,000	295,000
5	45,000	340,000
6	20,000	360,000

The cumulative net cash flow at the end of three years equals the amount of the investment, $250,000, so the payback period is three years.

EXERCISE 26–3

Proposal 1: The factor for the present value of an annuity for 6 years at 10%: 4.355

$60,000 × 4.355	$261,300
Less amount invested	250,000
Net present value	$ 11,300

Proposal 2:

Year	Present Value of 1 at 10%	Net Cash Flow	Present Value of Net Cash Flow
1	.909	$100,000	$ 90,900
2	.826	80,000	66,080
3	.751	70,000	52,570
4	.683	45,000	30,735
5	.621	45,000	27,945
6	.564	20,000	11,280
Total		$360,000	$279,510
Amount to be invested in equipment			250,000
Excess of present value over amount to be invested			$ 29,510

EXERCISE 26–4

(1) Present Value Factor for an Annuity of $1 = Amount to be Invested / Annual Net Cash Flow
Present Value Factor for an Annuity of $1 = $358,900 / $120,000
Present Value Factor for an Annuity of $1 = 2.991

(2) 20%

PROBLEM 26–1

(1)

Year	Present Value of 1 at 12%	Net Cash Flow	Present Value of Net Cash Flow
1	.893	$80,000	$ 71,440
2	.797	60,000	47,820
3	.712	60,000	42,720
4	.636	60,000	38,160
5	.567	60,000	34,020
Total		$320,000	$234,160
Amount to be invested in equipment			180,000
Excess of present value over amount to be invested			$ 54,160

(2) 1.30 ($234,160 / 180,000)
(3) yes

PROBLEM 26–2

(1) Project 1:

Year	Present Value of 1 at 10%	Net Cash Flow	Present Value of Net Cash Flow
1	0.909	$55,000	$ 49,995
2	0.826	50,000	41,300
3	0.751	45,000	33,795
4	0.683	40,000	27,320
5	0.621	40,000	24,840
6	0.564	30,000	16,920
7	0.513	15,000	7,695
		$275,000	$201,865
Amount to be invested			180,000
Net present value			$ 21,865

Project 2:

Year	Present Value of 1 at 10%	Net Cash Flow	Present Value of Net Cash Flow
1	0.909	$55,000	$ 49,995
2	0.826	55,000	45,430
3	0.751	55,000	41,305
4	0.683	55,000	37,565
5	0.621	55,000	34,155
		$275,000	$208,450
Amount to be invested			180,000
Net present value			$ 28,450

(2) Project 1:

Year	Present Value of 1 at 10%	Net Cash Flow	Present Value of Net Cash Flow
1	0.909	$ 55,000	$ 49,995
2	0.826	50,000	41,300
3	0.751	45,000	33,795
4	0.683	40,000	27,320
5	0.621	40,000	24,840
5 Res. value	0.621	60,000	37,260
		$290,000	$214,510
Amount to be invested			180,000
Net present value			$ 34,510

(3) Using a 5-year analysis, Project 1's net present value, $34,510, is greater than Project 2's, $28,450; thus Project 1 is more attractive.

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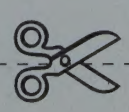

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stud•y

To apply one's mind purposefully to the acquisition of knowledge or understanding of [a subject].

(ITP Nelson Canadian Dictionary)

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